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# EXPORTS INTO IMPORTS

IN the middle of last week, while the astronauts were gathered in Amsterdam discussing the techniques needed to reach the nearer planets, a leader in *The Times* aired the proposal that long-range freighters required by R.A.F. Transport Command for the conveyance of heavy military equipment overseas should be obtained from the United States. Forty-eight hours later a vigorous letter from the chief executive of the Society of British Aircraft Constructors appeared in rebuttal of the suggestion. It is to be hoped that the cry will go up from all sides that such an expenditure of dollars would be lamentable, when the only reason that we have not got such aircraft is because the Service departments and the Ministry of Defence have steadfastly refused to reach a decision. It becomes obvious in the early stages of study that for this country, with its shrinking network of bases and staging posts, long-range freighters are a paramount necessity. Goodness knows, it is a doctrine which has been preached with some regularity in our pages.

In such a context it is depressing to recall that even today we do not have the operational staging post in the Indian Ocean needed to link Kenya and Africa with Australia. It was over 20 years ago that this paper first began preaching the necessity of the Empire Reserve Route and calling for such an aerodrome.

*The Times* began its leading article well enough by using as text the announcement that Kenya is to become a permanent station for two British battalions, and then from this commenting on the difficulties now inherent in moving troops and equipment from Britain to the Near and Far East in emergencies. The commentator went on to point out that if a Central Reserve is to be maintained at home, in order to reduce the size of British garrisons overseas, the means of moving it about is of particular importance.

The next stage in the discussion was to examine the relative merits of air transport and stockpiling. Again in such a comparison the writer in *The Times* supported the contention made in our pages before now that the advantages are with air transport. It is at this stage that the article makes its unfruitful suggestion that the comparatively small number of freighters required here could the more speedily and economically be brought from the United States.

For a long time now we have been under all kinds of compulsion to learn that dollars are hard to earn. And you cannot spend dollars until you earn them—unless you wish to ask for financial aid in some form. And surely it is not suggested that we do this! Among the reasons why the aircraft industry is pleased with its export figures is the amount of dollars in them. It seems a strange suggestion that such earnings should be applied to the purchase of freight aircraft.

Mr. Bowyer, in the space available to an author of a letter for publication in a newspaper, has dealt most adequately with many of the points raised. However, it does seem worth enlarging some more on one or two of the aspects since any decision to purchase large freighters from dollar sources would be a disaster of appreciable magnitude. It makes for rueful thinking that the need to discuss the possibility at all does not arise from any failure by the industry to appreciate the need for long-range freighters. Mr. Bowyer, in his letter, points out that project studies for such craft, superior in performance to the American aircraft now under consideration, have been before the appropriate Government departments for some five years.

It has become increasingly clear during that time that the decision to rely on imported guided missiles for certain deterrent duties, and the eventual development of our guided missiles for long-range purposes, would mean a reduction in the load on the industry. There was at one time the belief in official quarters that there would be no more manned fighters after the English Electric Lightning, but today it has become generally accepted that tactical fighting aircraft are still required. Numbers of long-range bombers, however, must be expected to be less. Now, in this set of circumstances, it has become clear that unless greatly enlarged civil sales or export orders for military aircraft are received, the industry, with its corps d'elite of skilled labour and tightly knit teams of technicians, would have to contract. Furthermore, those looking ahead into the future were becoming increasingly concerned as to how export sales could be kept up if British aircraft development were going to be progressively restricted.

It was one of the stimuli to study designs for the long-range heavy freighters that development of successful types for the R.A.F. would lay the foundation for another long string of export successes. And now, for lack of decision in official quarters, we see the proposal being made that just such craft should be bought with dollars that may well have been among those earned by successful British designs. No wonder that the question has to be asked about the delay in making up the official mind. In these days, when man-made satellites are putting girdles round the earth every 40 minutes or so, five years to reach an official decision is more than sluggish, it cannot be tolerated.

# MATTERS OF MOMENT

## And Still More Exports

APPROPRIATELY enough, almost on the eve of the opening of Britain's annual aeronautical shop window at Farnborough, the Society of British Aircraft Constructors has been able to announce a remarkable new "high" in the aviation export figures achieved over the first seven months of this year. The total value of aeronautical goods exported from January to July inclusive amounted to no less than £91,910,080—which represents an increase of very nearly 50% above the £62,147,710 for the same period last year. If the monthly average corresponding to this total is maintained for the rest of the year, the 1958 export total should reach the record figure of more than £157 million. Total aeronautical exports since the end of the late War amount to no less than £723 million worth.

Aircraft and parts sold abroad during July amounted to £10,013,317; aero-engines, £4,006,584; electrical appliances, £404,274; tyres, £44,006; and instruments, £208,615. These figures give further points on each of the export curves in the special graph given in our August 29 issue (page 292) and they show in most instances a rather steeper upward trend than the previous variations in the curves might have suggested. For example, the value of electrical appliances exported in July was very nearly twice that for the previous month; and instruments and tyres showed similar sharp increases.

During the month under review, Canada bought £2,695,300 worth of aircraft and parts; India, £2,044,541 worth; Western Germany, £1,436,228 worth; and the United States £1,204,828 worth. In the first seven months of this year, India proved to be the industry's best customer with £12,934,992 spent on British aeronautical products. Canada came next with £12,091,717, followed by America (£5,715,514), Western Germany (£4,326,186) and Australia (£2,249,808). Four more countries, says the S.B.A.C., bought more than £1m. worth of aircraft and parts. Dollar sales to the United States and Canada—excluding aero-engines and components—amounted to nearly £18m.

## Silence With Safety

WHEN the airlines' turbojet orders began to be placed at the end of 1955 few people considered that the problem of noise might be one of the major difficulties to be surmounted before this new generation of aircraft could be brought satisfactorily into service. Probably it might never have been considered to be a problem—until the complaints started to pour into the offices of the authorities concerned—if the Port of New York Authority and, later, the British Ministry of Transport and Civil Aviation had not taken such firm stands.

Now, after a period during which there seemed to be something of an impasse developing, matters appear to be sorting themselves out. On pp. 375-6 we summarize the main points in an M.T.C.A. statement which was made last week. The operators, manufacturers and authorities are obviously coming to terms in a reasonably satisfactory way. Within a few days we can expect to see a Boeing 707-120 at London Airport for trials at a restricted weight and there is every reason to suppose that a Tu-104 will soon be coming over for similar assessments.

The end of it all will, no doubt, be a series of compromises. No one can expect the operators to sacrifice too much in the way of economics for the sake of peace, but as much as possible will be done to reduce turbojet clamour by the use of suppression systems which do not involve too heavy a price in terms of loss of thrust. Thereafter the balance of the problem will probably be dealt with by the use of special local routeings, faster climbs and power-restriction according to take-off weight. Conceivably the population may grow accustomed to the new noise and some relaxation would be possible. In the meantime it may be necessary for some aircraft to use airports other than L.A.P. and those under the control of the P.N.Y.A. when taking off at long-haul weights.

The important thing is to make quite sure that restrictive measures do not involve operating techniques which increase the hazards of airline flying or—which comes to much the same thing—the skill demanded from the flight crews. The use of restricted thrust to suit weights and runway-lengths may mean that take-offs are being made less safe; and the use of very high rates of climb may involve aircraft attitudes which limit vision from the flight deck and climb-speeds which are a little too near the margin of safety. Put more bluntly, we must not find ourselves saving the eardrums and nerves of the population at the risk of their lives—as well as those of the people who are flying.

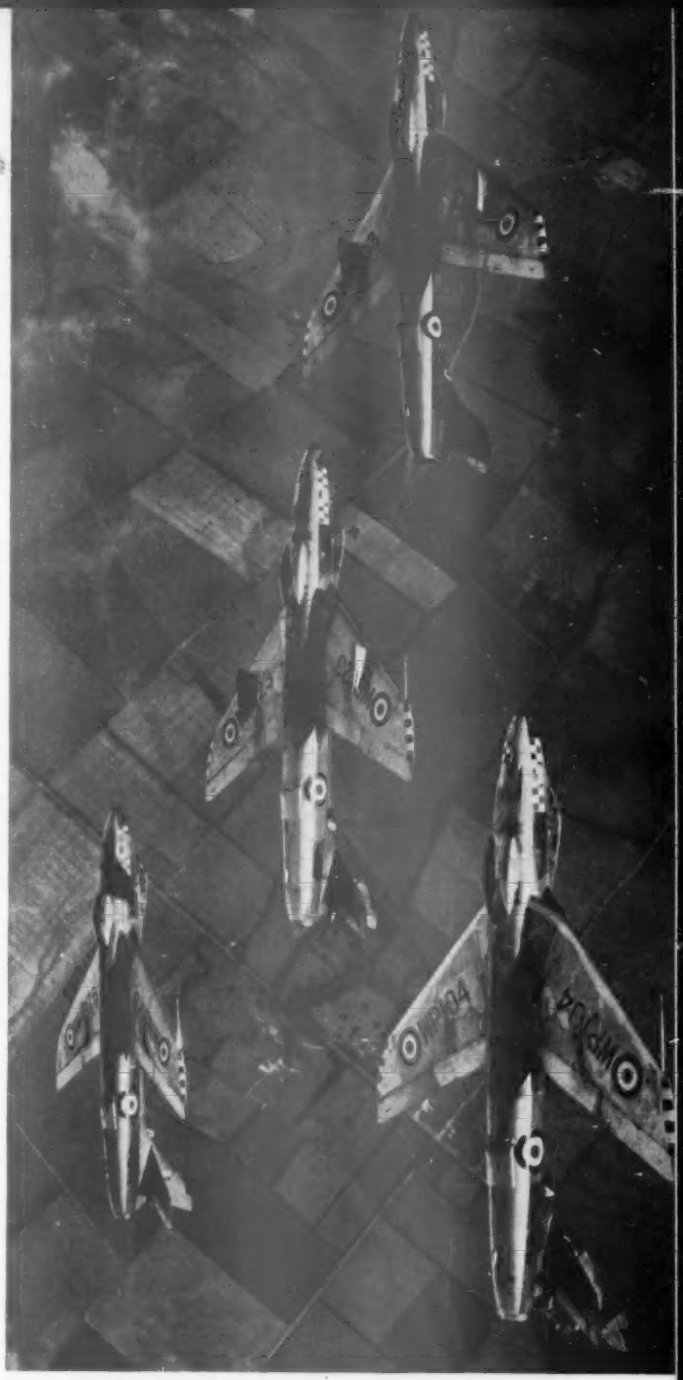
The compromises will be very delicate ones. It would not be too much to say that the future of air transport depends on the maintenance of a good safety record during the first year or more of the so-called "jet age."

## Symposium on Combustion

THE Combustion Institute held its seventh international symposium in London and Oxford over the period August 28 to September 3. An indication of the interest in both theoretical and practical fields within the broad subject of combustion is that more than 100 papers were to be discussed or presented in précis form during the course of the symposium—all of them within the theme of "Physics and Chemistry of Flames."

Evidence of the widespread and truly international appreciation of the importance of the work being reported by the Combustion Institute was to be seen at the inaugural meeting on Thursday morning, August 28. Held in the historic lecture hall of the Royal Institution some 300 people of many tongues and creeds gathered to see and hear what turned out to be a minor historic event in its own right. The proceedings were opened by LORD BRABAZON OF TARA, who, as president of the Royal Institution welcomed the visitors, among whom were

EXPORTED.—One of the aircraft that has done so much to boost Britain's aeronautical export figures—the latest of which are given on this page—is the ubiquitous Viscount. This is the first South African Airways Viscount 813 being rolled out at Hurn.



HUNTERS UP.—Among the proponents of Hunter aerobatic finesse are members of No. 56 Squadron. Here, four of the Squadron's aerobatic team, equipped with Mk. 5 aircraft, practice for a display.

many distinguished aeronautical engineers and introduced to them the main speakers.

SIR CYRIL HINSHELWOOD, president of the Royal Society and Lee's Professor of Chemistry in the University of Oxford, reviewed the field of combustion.

Second speaker was DR. BERNARD LEWIS, president of the Combustion Institute, who discussed the development of combustion sciences. He referred to the existence of a renaissance in combustion research.

Final speaker of the formal programme was SIR ALFRED EGERTON, F.R.S., emeritus Professor of Chemical Technology at Imperial College, who with an admirable mixture of humour and humility recalled that some of the early scientific work in combustion had been carried out by Davy and Faraday in the laboratory below the gathering about 150 years ago.

At the conclusion of the advertised activities it was announced that the Combustion Institute had decided to make certain awards in the form of medals for work and outstanding contributions within the field. In presenting the first of these, DR. THEODORE VON KARMAN said that when he was asked to present the first Bernard Lewis Medal for brilliant research in combustion to Dr. Lewis he was struck by the somewhat unusual procedure. Nevertheless he now thought this to be an excellent idea: "to honour a man in his own lifetime will permit him to enjoy it."

The second award was presented by PROF. A. R. UBBELOHDE, Professor of Thermodynamics at the University of London, and, in this case also, the man honoured was the one giving title to the award. In presenting the first Alfred Egerton Medal to Sir Alfred for long and meritorious work and brilliant research, it was recalled that his first paper was presented in 1911.—D.S.C.

## A 50,000-ft. Target

A CANBERRA U.10, the target version of the Canberra B.2, has flown above 50,000 ft. under automatic control. This is an unmanned version of the Canberra developed by Short Bros. and Harland, Ltd., for guided-weapon trials.

According to the company's statement, during its entire flight to over 50,000 ft. the Canberra was under automatic control, although for safety reasons a monitoring pilot was aboard. The pilot did not, however, touch the controls from take-off to touch-down.

The Canberra U.10 does not need to be accompanied by a shepherd aircraft. All its systems are operated automatically; these include the flaps, airbrakes, wheel-brakes and undercarriage as well as the radio and ancillary services such as telemetry, navigation, miss-distance recording and command destruction. A self-contained automatic approach and landing system is installed.

## Aerobatic Victor

DURING a recent photographic sortie from Radlett for the purpose of some pre-Farnborough air-to-air shots of the latest Victor (see page 378 for the result), the photographed machine exhibited its lively handling characteristics by doing a barrel roll. This in itself is a noteworthy achievement for a bomber of such size, but is all the more remarkable in this instance because the aircraft concerned was making its first flight and was equipped with underwing long-range tanks. In point of fact two rolls were accomplished, with a pause in between to take stock of the situation; they were at an altitude of around 12,000 ft. and somewhere in the region of Huntingdonshire..

Our chief photographer reports that—for obvious reasons—this aerobatic exercise was accomplished some considerable distance away from the photographic Hastings flown by Sqn. Ldr. H. G. Hazelden, and out of the normal working range of the cameras. Even so, he says, the manœuvre was spectacular enough; and the size of the "barrel" was in keeping with the size of the aircraft.

On this occasion, the Victor was flown by Flt. Lt. J. Allam, one of the company's test pilots. It was he, incidentally, who was the pilot of the Victor when it achieved the distinction of attaining a speed in excess of Mach 1.

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*Photograph copyright "The Aeroplane"*

THIRSTY WORK.—Seen at the U.S.A.F.'s open day at Wethersfield, Essex, on August 23 was a Boeing KB-50J with auxiliary jet pods. In this picture three North American F-100D Super Sabres are being refuelled by it, the central aircraft about to make contact.

## Space Medicine Symposium

A SYMPOSIUM on Space Medicine, the first in Britain and, it is believed, the first international meeting on the subject ever held, is being organized by the British Interplanetary Society, with the co-operation of the R.A.F. Institute of Aviation Medicine at Farnborough, and will take place on October 16 and 17 at the British Medical Association's headquarters at Tavistock Square, London, W.C.1.

From Farnborough, papers have been promised on "Vision and Orientation at Extreme Altitudes," "Man's Thermal Environment during Interplanetary Flight," "Heat Exchange between Man and his Environment on the Surface of the Moon," and "Impairment of Human Performance in Control." The Applied Psychology Research Unit at Cambridge is contributing a paper on "Effects of Sensory Deprivation," a condition which may well arise in a tiny sealed cabin far out in space.

A team from the U.S. Office of Naval Research will be led by Cdr. George Hoover, who is to read a paper on "The Man-Machine System in Space Vehicles," and other contributors from his team are Capt. Sidney S. Sherby of the O.N.R., Dr. H. E. Sheets of General Dynamics Corpn., A. Mayo of Douglas Aircraft, and Owen Q. Niehaus of the Bell Helicopter Corpn. Other contributors from abroad are Dr. M. P. Lansberg of the National Aeromedical Centre of the Netherlands, and Dr. H. Bjurstedt of the Laboratory of Aviation and Naval Medicine at Stockholm.

The Symposium coincides with the 25th anniversary of the foundation of the British Interplanetary Society, which is celebrating the event with a dinner at the Waldorf Hotel on the 17th.

Anyone interested in either the Symposium or the dinner should write for a prospectus and application form to the British Interplanetary Society, 12 Bessborough Gardens, London, S.W.1.—A.E.S.

## Preserving the Mosquito

DE HAVILLAND'S celebrated aircraft of the Second World War, the Mosquito, has an unforgettable place in history; the ultimate fate of the prototype is now the concern of a Mosquito Appeal Fund which has been set up with the aim of preserving it for posterity. It hopes to gain a sum of £1,000 for this purpose.

The first Mosquito made its maiden flight from a field on May 15, 1941, piloted by Mr. Geoffrey de Havilland, Jnr. It was designed and built at Salisbury Hall, near St. Albans, whence the de Havilland "Mosquito Project" team was dispersed for secrecy and safety from bombing.

As Salisbury Hall is now an historic monument, it seems appropriate that it should become the permanent home of the Mosquito, which itself would be a memorial to all who built and flew the type. As a wooden aircraft, a suitable hangar is necessary to keep it from deterioration; the de Havilland Aircraft Co., Ltd., has offered to reassemble and maintain the aircraft.

Those who want to make contributions to the Fund should send them c/o Midland Bank, Ltd., 122 Finchley Road, London, N.W.3. The secretary of the Fund is Mr. W. J. Goldsmith, and the committee consists of Sir Geoffrey de Havilland; Mr. C. H. Gibbs-Smith; Miss Constance Babington-Smith; Gp. Capt. John Cunningham and Mr. Roland Rendell.

## A British Achievement Abroad

IT is gratifying to learn that British sailplanes continue to make outstanding achievements overseas. Our Canadian correspondent writes that on August 18 a Slingsby Skylark 3D made the longest sailplane flight from Canadian soil ever recorded.

The flight was made during the annual gliding championships of the Soaring Association of Canada by Mr. Gordon Oates, who flew the 304 miles from Brantford, Ontario, to Monticello, N.Y., in 5 hr. 45 min. His average speed was 52.9 m.p.h.

## Back to Hawker Siddeley

MR. S. D. DAVIES, B.Sc. (Eng.), F.R.Ae.S., has returned to the Hawker Siddeley Group which he left, as chief designer of the Avro team, in 1955 to become managing director of Dowty Fuel Systems, Ltd. In announcing his appointment, Sir Roy Dobson, the Group's managing director, explained that Mr. Davies is to take charge of engineering work on a new project, details of which cannot be given for security reasons. He will, in fact, be responsible under Sir Arnold Hall, the technical director of the Hawker Siddeley Group, for a special unit dealing with this project.

There has been much speculation as to the nature of Mr. Davies' new task, for it is an open secret that within the Group a number of "secret" projects are being considered. Among them, for example, there have been reports of a supersonic fighter with vertical take-off capability and it might well be that it is the design development of this project for which Mr. Davies will be responsible.

An interesting point is that in the official announcement concerning this important appointment, there is no reference—in relation to the new project—of any particular Hawker Siddeley company. This seems to reflect the growing tendency in the Group to consider its aeronautical section as a single unit rather than being divided among a number of individual companies.

However, be that as it may, Mr. Davies' appointment is a significant one for he can be counted among Britain's leading aeronautical engineers. Much of the success of the Vulcan was due to what Sir Roy Dobson referred to as his "brilliant design and careful development work." Sir Roy added that Mr. Davies "is a practical aviation engineer of the highest order and will add great strength to our design team."

Born in 1906, Stuart Davies served his apprenticeship at Vauxhall Motors at Luton from 1923 to 1925 after which he became a wind-tunnel assistant at Vickers-Armstrongs. He did his aeronautical engineering training at the Northampton Polytechnic, where he obtained his Degree, and he was made an Associate Fellow of the R.Ae.S. in 1931. From 1931 to 1936 he was a technical assistant and project engineer at Hawkers after which he spent a year as chief designer of the Aeronautical Corporation of Great Britain, Ltd. He was made a Fellow of the Royal Aeronautical Society in 1937.

Mr. Davies joined the Avro company in 1938 as assistant designer to the late Roy Chadwick. In 1940 he became manager of the experimental shop and in 1946 was appointed to the post of chief designer to succeed Roy Chadwick who lost his life in a Tudor accident. From then until leaving the company in 1955, he was responsible for the design and development of the Shackleton, of the Avro 707 series of experimental deltas, and of the Vulcan V-bomber. During his subsequent period with the Dowty Group he was very largely responsible for the successful expansion of Dowty Fuel Systems, Ltd., from a small section of Dowty Equipment, Ltd., into a thriving and self-contained concern.

# *News of Aircraft, Engines and Missiles*

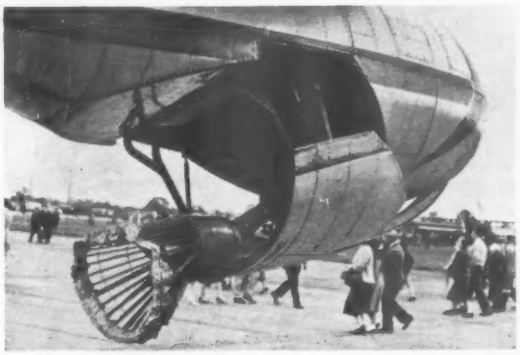
**GNOME NEWS.**—As suggested in our issue for August 15, the 1,000-s.h.p. D.H. Gnome will first be installed in a Westland Whirlwind helicopter test-bed. This will make its first flight by early next year; the turboprop version of the Gnome will be flying by the autumn of next year.

**J58 TEST.**—A 50-hr. test of the Pratt & Whitney J58 turbojet has been made, six months after completion of the first engine. The J58 is a single-spool design and will have a thrust of about 30,000 lb. at high Mach numbers.

**GERMAN JET.**—The first turbojet developed in Western Germany has been successfully test-run at the Ludwigsfelde works. It is to power the Baade-Bonin BB.152 airliner being produced for Lufthansa.

AMERICAN UTILITY. — The two-seat Morrisey 2150 has been given a type certificate by the C.A.A. and is now in production. A 150-h.p. Lycoming engine gives the aircraft a top speed of 148 m.p.h.

**LYCOMING ORDERS.**—More than 500 orders for the 250-h.p. Lycoming 0-540 six-cylinder engine, as fitted to the Piper Comanche and Aero-Commander Model 500, have been received by the company since the engine received its C.A.A. certificate four months ago.



NEW DROGUE.—The Boeing KB-50J tanker used by Tactical Air Command for refuelling fighters uses a new type of semi-collapsible drogue, with a fluorescent fabric band to aid its extension.

*Photograph copyright "The Aeroplane"*

**NEW SOUTHERN CROSS.** — The newly formed Australian company, Southern Cross Aviation, Ltd., is building the prototype of a four-seat all-metal low-wing monoplane for private/executive/agricultural work, at Toowoomba, Queensland. Known as the SC-1, it is to have a 180-h.p. Lycoming engine and should achieve 160 m.p.h. The range is expected to be about 750 miles, and the payload in the agricultural rôle, 1,000 lb. The SC-1 designed by Mr. N. D. Hodgekiss, formerly on the engineering staff of the Department of Civil Aviation, and before that with Handley Page, Ltd., is being built in the works of Toowoomba Foundry, Pty., Ltd. It is to fly by the end of this year.

**GYROPLANES AGAIN.**—A two-seat open-cockpit KD-1A gyroplane of 1935 design is being built by the Kellet Aircraft Corpn. in the U.S. to re-introduce the type for agricultural and other jobs requiring STOL performance. Powered by a 225-b.h.p. Jacobs L4-MA-7 radial engine, the KD-1A has a maximum speed of 125 m.p.h., a minimum speed of 22 m.p.h., and can make "jump" take-offs with engine assistance to the rotor. It is expected to sell for less than £3,000.

**KAMAN PRODUCTION.**—A report issued by the Kaman Aircraft Corpn. reveals that the company's sales for the first six months of 1958 amounted to $9,416,473, compared with $7,139,800 for the corresponding period of last year. Net earnings in the same periods were $207,147 and $144,520. The company is producing the H-43 and H-43B helicopters for the U.S.A.F., and the HU2K-1 and HUK-1 for the U.S. Navy.

**STARFIGHTER CHANGES.**—Temporary grounding of U.S.A.F. Lockheed F-104 Starfighters is for eight modifications to be made, says *Aviation Daily*. These changes are concerned with the General Electric J79 turbojet installation and include an improved fuel control, some change to the inlet guide-vane port filter, a manual override switch for the "rack reset," an additional manual override switch for nozzle-area control, a "ruggedized version of the Red Bank amplifier" and a modified high-pressure oil filter. The J79-3 is to have the inlet guide-vane control modified for improved efficiency during gun firing.

**ARROW NEWS.**—The second Avro Aircraft Arrow recently achieved 1,200 m.p.h. in the hands of the company's chief test pilot, Janusz Zurakowski, who also climbed supersonically with it. The third Arrow is due to fly over the Canadian International Air Show at Toronto today, September 5. The first five Arrows are to have the Pratt & Whitney J75s, thereafter Iroquois turbojets will be installed.

**DC-8 HOURS.** — The prototype Douglas DC-8 returned to the company's Long Beach plant on August 22 after accumulating 72 hours' flying time in 23 flights. Its maiden flight was on May 30. Following an inspection period of three weeks, the aircraft will go back to Edwards A.F.B. to continue proving flights. Seven pilots, including the first flight crew, have now flown the DC-8.

**GERMAN FIRST.**—On August 6 the first French Noratlas transport built under licence in West Germany by Hamburger Flugzeubau G.m.b.H. made its maiden flight. The company is to build 112 of these transports for the Luftwaffe.

SUPERSONIC TRAINER. —Production of the Northrop T-38 supersonic trainer is now well under way and the first aeroplane was rolled-out on August 18. This view of the production line shows the characteristic Area-rule treatment of the fuselage and the slightly swept-back flying surfaces. Northrop has designed the N-156F "counter-air" fighter, based on the T-38. Powerplant for both aircraft is a pair of General Electric J85 2,500-lb. thrust turbojets or two Fairchild J83s, both types of engine having afterburners.

SIKORSKY AMPHIBIAN.—Mock-up of the Sikorsky HSS-2 (S-61) shows its general resemblance to the single-engined S-62. The HSS-2 for the U.S. Navy has a coupled General Electric T58-6 powerplant and is amphibious. The main wheels retract into floats and the tailwheel is fixed.

**J79 DATA.**—Thrust of the General Electric J79 turbojet is 18,000 lb. with afterburning. Weight is 3,200 lb. The second series J79s have 6% more thrust and a lower s.f.c., the turbine diameter being increased by about 2 in. Maximum air mass flow is 162 lb./sec. and compression ratio is 12 : 1. Total running time of all versions is more than 57,000 hr., including 10,200 hr. in flight.

**NEW RESEARCH ROCKET.**—An Australian-designed two-stage rocket for atmosphere research will be launched from Woomera next month. Known as Long Tom, it should rise to about 120 miles.

**VENETIAN VARIETY.**—Light aircraft, particularly U.S. types, were of special interest at the seventh international aeronautical exhibition at Venice. The U.S. types included the Cessna 175 and Skylane, Piper Comanche and Apache, and the Mooney M-20. Italy was represented by the Aeromere F-8L Falco, the di Bernardi Aeroscooter, the Agusta-Bell 47J and Lualdi L-55 helicopters, and the CCV-8 sailplane. From Germany were the two-seat Sperling SF-23, a single-seat Klemm Kl-35, and a German-built Turbulent, presumably a Stark. Great Britain appears to have been notable by its lack of exhibits.

**MISSILE DOPPLER.** — Ryan has developed a small Doppler radar for the Nike-Zeus AICBM which will home on to the nose-cone of an ICBM.

**BRUSSELS AWARDS.**—Two Soviet helicopters, the Kamov Ka-18 and the Mil Mi-4, have been awarded gold medals of the Brussels World Fair. The Ka-18 is now being used in increasing numbers in Russia for pest control and prospecting work and Mi-4s have made long-distance flights from Moscow to the North Polar regions, about 4,350 miles.

**SUPERSONIC AIRLINERS.** — Mr. L. F. Nicholson, head of the aerodynamics department at the R.A.E., has said at a British Association lecture that supersonic airliners could now be envisaged which would challenge subsonic transports. There were no insurmountable technical barriers to flight at high supersonic speeds; development was aimed at economic supersonic flight at Mach 2. There were signs that aerodynamic efficiency could be maintained at speeds above Mach 5.

### Next Week

THE issue of THE AEROPLANE dated September 12 will be our annual Second S.B.A.C. Report.

It will include a complete survey of the exhibits in the static show at Farnborough, covering guided weapons, aircraft and aero-engine accessories, instruments, armament and survival gear and ground equipment, together with references to specially new features.

There will also be pictorial pages, and our regular features will also be included.

This issue will cost the usual 1s. 6d.

**AUSTRALIAN MEMORIAL.**—The commemorative building at Brisbane which houses Sir Charles Kingsford Smith's Fokker monoplane, "Southern Cross," was officially opened on August 17.

## *Commercial Aviation Affairs*

**CAMBRIAN RETRENCHMENT.**—Because of continued lack of traffic over certain routes, Cambrian Airways have decided that, after October 25, the scale of their operations will be reduced. Cambrian's three D.H. Herons, used primarily for the development of marginal routes, are to be offered for sale and there will be a reduction by at least a third in the strength of the flying staff. Details of the retrenchment plans are not yet finalized.

**P.A.A. STATISTICS.**—Pan American Airways carried 50% more American passengers on their round-the-World flights in July than in the same period last year. There was also a 16% increase in the number of people using this service in the first seven months of this year than in the corresponding period of 1957. Passengers bound for Europe from the U.S. are 10% up on last year and in the first week of July reached a peak number of 5,215.

**SINGAPORE AIRPORT.** — The Malayan Government has approved the development of Singapore Airport. The Colony's Minister for Communications and Works has stated that a new operational control centre will be ready by 1960, when the present control system will probably be inadequate. Work is to begin on a new 120-ft.-high control tower and a seven-storey building with more than 40,000 sq. ft. of floor area.

**SERVICE EXTENSION.** — It is reported that Air Ceylon plans, before the end of the year, to extend its new Colombo - Singapore service to Hong Kong and Canton, China, operating once a week.

**MALAYAN EXPANSION.** — A new service from Singapore to Hong Kong is to be operated soon by Malayan Airways. According to local Press reports, the airline also plans services to Manila and Tokyo. Two DC-4s will be used.

**SLICK TO EAGLE.**—Eagle Aviation has now taken delivery of two Douglas DC-6As purchased from Slick Airways, Inc., of the U.S. They will be equipped to seat 98 passengers in fully reclining seats mounted on rails to facilitate easy conversion from passenger to freight transport. In freight form a payload of about 10 tons can be offered. The aircraft will now be designated DC-6A/B and will begin operations on October 1.

**CAPE TOWN'S AIRPORT.**—During the next year or so Cape Town's D. F. Malan Airport is to be equipped with DME, VOR and ILS.

**FOR EFFICIENCY.**—The Airways Trophy, awarded annually to the most efficient aerodrome fire-service unit in the British Isles, has been won by the Inverness (Dalcross) aerodrome unit. This is the first time that a Scottish aerodrome has won the trophy; the Joint Parliamentary Secretary to the M.T.C.A., Mr. Airey Neave, M.P., is to visit Inverness aerodrome on September 9 to present it.

**MOSCOW PROBLEM.**—According to *Aviation Daily*, Russia's lack of high-grade aviation fuel makes it necessary for Sabena and Air France to take aboard enough fuel for the return trip to and from Moscow, with arrangements, in the case of Sabena, for refuelling, if necessary, on the return flight at Copenhagen. K.L.M. and S.A.S. use DC-6s, to which the difficulty does not apply.

CZECH EXPORTS.—As noted last week, 130 Super Aero 45s are to be supplied by Omnipol to the Russian airline, Aeroflot. The first batch is seen here awaiting delivery.

# News About People

**NATO AIR ADVISER.**—Dr. J. W. Abrams of the Canadian Defence Research Board, who has been scientific adviser to the Chief of Staff of the R.C.A.F. since 1954, is being lent to SHAPE, for work in connection with the scientific analysis and planning of NATO air defences. His services have been requested by Gen. Norstad.

**TUPOLEV HONOURED.**—The 70-year-old Soviet aircraft designer Andrei Tupolev has been awarded the Grand Prix of the Brussels World Fair for his Tu-114 turboprop airliner.

**SPACE CHAIRMAN.**—On January 1, 1959, Gen. James H. Doolittle will become chairman of the board of directors of the Space Technology Laboratories of the U.S.A. This body is devoted exclusively to ballistic missile and space problems and has overall scientific responsibility for the U.S.A.F.'s Thor, Atlas, Titan and Minuteman missile programmes. Previously a division of the Ramo-Wooldridge Corpn., the laboratories will become a separate corporation with an independent board of directors.

**PLESSEY MANAGER.**—Mr. George Campbell, B.Sc., A.R.C.S.T., F.R.I.C., A.M.I.Mech.E., has been appointed general manager of the Chemical and Metallurgical Division of the Plessey Co., Ltd. He was previously technical manager and deputy general manager of the company's Towcester plant.

BRISTOL SALES.—Mr. W. H. Rees has been appointed sales manager of Bristol Aero-Engines, Ltd. He has hitherto been concerned with the sales promotion of the Orpheus.

**MARCONI REPRESENTATIVE.**—Mr. B. F. Kane, O.B.E., B.Sc.(Eng.), M.I.E.E., has been appointed sales and technical representative for Eastern Europe by Marconi's Wireless Telegraph Co., Ltd., with his headquarters in Vienna. He was formerly deputy chief of sales, radar division.

NOT DEJECTED.—Seated in the downward ejector seat of a Lockheed F-104A Starfighter is Wg. Cdr. R. P. Beamont, chief test pilot of the English Electric Co., Ltd., who has recently returned from the U.S.A. where he flew most of the Century-series fighters. A reference to his performance in the P.1B Lightning is on pages 382-3.

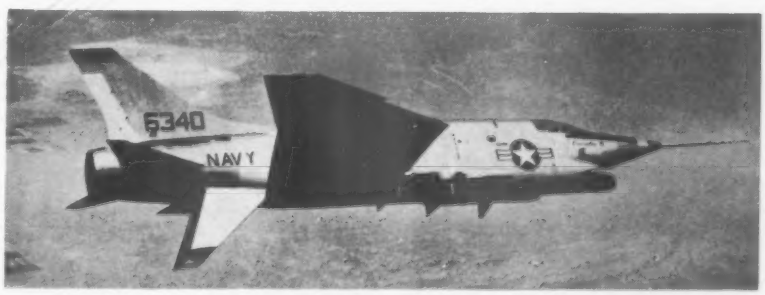
**BROWN BROS. POSTS.**—Mr. A. E. Collins, formerly sales manager of Brown Brothers (Aircraft), Ltd., is now commercial manager of the company and of its subsidiary, Johnson and Starley, Ltd. He will, however, continue to direct the overall sales policy of the former company in his new position. Mr. L. G. Pratt, previously assistant to Mr. Collins, succeeds him as sales manager.

**GLIDING ACCIDENT.**—We regret to record that Mr. Norman Ring, C.A.I., A.F.R.Ae.S., was killed in an accident to a Baby Bowlus sailplane at Fergus, Ontario, during the recent annual championships of the Soaring Association of Canada in what was the first fatal gliding accident in Canada for 10 years. Mr. Ring, who was 37, was for a time with Westland Aircraft at Yeovil, later returning to Canada and joining de Havillands. In 1946 he went to Avro Aircraft, working on the Jetliner, CF-100 and Arrow, and at the time of his death was chief of airframe design, a post to which he was appointed last year.

**LAYCOCK RETIREMENT.**—Mr. S. Walker has retired as managing director of Laycock Engineering, Ltd., and has been appointed vice-chairman of the company. Mr. W. E. Thompson and Mr. K. Walker have been appointed joint general managers. Mr. S. Walker has also been made a director of Birfield, Ltd.

**EXPORTS TO HOLLAND.** — Mr. S. F. Smith, sales manager of the Industrial Instruments Division of Firth Cleveland Instruments, Ltd. (a subsidiary of Simmonds Aerocessories, Ltd.), of Treforest, Glam., is visiting Holland, to promote further sales of British equipment. He is accompanied by Mr. D. T. Broadbent, an executive director and chief engineer.

# Military Aviation Affairs




NAVAL FIGHTER.—The Chance Vought F8U-3 Crusader is armed with Raytheon Sparrow III air-to-air missiles. The large fins under the rear fuselage are lowered for stability at high speed.

**CARRIER'S END.**—The U.S. aircraft carrier "Enterprise," the flagship of Admiral Halsey during the early part of the Second World War, was recently taken from Brooklyn to the breakers.

**LUFTWAFFE TUTORS.**—The first 20 of 100 R.A.F. instructors who are to train aircrew for the West German Air Force are now at Landsberg air base.

**JINDIVIKS FOR BRITAIN.**—The 50 or so Jindivik target aircraft that have been ordered by the Ministry of Supply from Australia (see THE AEROPLANE for August 22) will be supplied by the Government Aircraft Factory at Fisherman's Bend and not by the private Commonwealth Aircraft Corporation, as suggested in our issue for June 13.

# Thoughts after a Flight in the Comet 4

DE HAVILLANDS were certainly unlucky in their choice of day for the first "public" passenger demonstrations of the Comet 4. But all went well, if a little damply for many, and the general weather situation at least showed up the Comet as a comfortable and handleable aeroplane in displeasing meteorological conditions.

The first of the demonstration flights on August 28 left Hatfield in heavy rain and with mist reducing visibility to less than 1,000 yards—and returned in even heavier rain and with visibility down to about 600 yards. But this and the later flights of the day went like clockwork—notwithstanding the (metaphorical) smell of brimstone in the nostrils of the people on the first load, who had experienced a mild lightning strike while descending through the base of cumulo-nimbus clouds.

On our flight—in G-APDA, the first Comet 4 for B.O.A.C. and the one which had recently been to New York—we rolled quickly through the rain-swept murk along the taxi-way, turned on to runway 24 and took straight off from the roll after a run of about 25 seconds and before the B.O.A.C. cabin crew could have realized what was happening. As soon as the undercarriage and flaps were snugly up we made a gentle turn to port over the grey cloud-scud-mottled fields of Hertfordshire and set off to try to find some open sky. We found it after less than 20 minutes—towards the Belgian coast. In this sky vapour trails from two military aircraft hung like rapiers across the cerulean blue which was bounded towards the north-west by cumulus tops rising up to 30,000 ft. or more.

All too soon the Comet turned and started the descent through the thunderstorm area, which seemed to be more or less solid over the whole of the south-east of England. But even in the worst of the weather the Comet rode comfortably enough.

The entire 85-minute operation gave the passenger an impression of effortless ease—which is as it should be. Even the long, powered final approach, from the region of Stansted Airport, with its enormous runway, and down into the mist which still wreathed the area of Hatfield, left the passenger with that same natural feeling right up to the beautifully judged landing.

By other, earlier standards the whole of the Comet fuselage, whether on climb or during cruise, is quiet, comfortable and almost vibrationless. If one must be hyper-sensitive, it could be said that the forward part of the cabin—which will be that for the high-fare passengers in any mixed-class arrangements—is much the quietest. There is quite a marked difference as one walks through the cabin bulkhead forward of the leading edge.

In the centre area of the cabin it is still quiet, but there is a faint appreciation of the fact that four Avons are working beside one's seat. In the rear of the cabin there is a gentle efflux-rumble. But, throughout the length of the cabin, the only noticeable "noise" is one of "air-rush"—which seems to be from the air-conditioning rather than of aerodynamic origin, and which is only discovered when riding in a turbojet aircraft.

This first production Comet 4 is laid out for 56 passengers, with four-abreast first-class seats throughout. Although pleasant, the seating and decor of G-APDA are not the final ones for the B.O.A.C. Comets. In the flight shed the second of those for the Corporation could be inspected and this has an interior which will be more typical of the standard. It has 16 Microcell Sleeperseats in the comfortable (or should one say super-comfortable?) forward part of the cabin, and 43 tourist seats, five-abreast, in the aft area of the cabin.

Another type of layout—which will probably be the one used on the initial Atlantic services later this year—has the 16 de luxe seats forward and 24 of these seats, four-abreast, aft. This will presumably be the Monarch standard for the once-a-week service with which the Corporation will make a start. Well, it should be comfortable enough for the most sybaritically minded passengers, and even the economy-class passengers, when they travel later in, maybe, an 81-seater, will not be staying so long in the Comet at any time that a little comfortable discomfort will be minded. And, unless the aircraft is flying with a 100% load factor, some of these less favoured passengers will be able to put up the seat-rests and enjoy first-class standards of space sideways, if not fore and aft.

B.O.A.C. has done quite a job (through Gaby Schreiber and Associates) with the Comets and with other aircraft in the Corporation's fleets. Normally the hardened air traveller is inclined to sniff at professional ideas of decor—unless the interior arrangements are too drab, or so violently colourful and clever that he suspects directors' wives of having taken a hand in the matter. Judging from a look at the Comet, the new Corporation decor is quite a masterpiece of subtlety, with restful tones for most of the furnishings and with predominant colours used only for accessories such as seat pillows, headrests and (believe it or not) magazine covers. Coupled with the use of good-quality materials, the general appearance is such that even the most cynically practical of aeronautical engineers should be able to forget for a while that there is only some metal skin separating him from the chill emptiness of brute nature at 35,000 ft. or so.—H.A.T.

This new picture of the flight deck of the Comet 4 shows that the layout is very similar to that of the Comet 1. A weather-mapping radar display can be seen below and on the right of the captain's flight instrument panel, on which the six basic instruments include the two for the Smiths Flight System.

# FARNBOROUGH FIRST REPORT

Photograph copyright "The Aeroplane"

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The mists had in nowise cleared from the seven-mile ridge of the Hog's Back as the first arrivals began to clog the normal swift-moving stream of traffic along the high road. It was still overcast as the big tent began to fill up; no doubt the news had got around that the vast marquee housing the static exhibition would be the better for the attention of some of our experts in air-conditioning once the sun warmed things up.

During the eve-of-the-show dinner the night before, various people had voiced the idea that the dining room at the Dorchester and the adjacent anti-rooms would be all the better for similar treatment.

Some thousand guests applauded the sentiments expressed by the president of the S.B.A.C., Mr. Aubrey Burke (see p. 369) and replied to by the Minister of Transport and Civil Aviation, Mr. Harold Watkinson. The latter's remarks about the permissible noise-level for modern airliners were followed with interest but views were certainly mixed about his suggestion that neither operators nor manufacturers should be in too much of a hurry to introduce new types after the present generation of sub-sonic aircraft.

Talking with people around the Show one found that the topic most likely to be raised, whether the exhibit was aircraft or electronic, was how to finance the development of new products. In the expanding world of technological industry there is no standing still; either one presses on with development or one is passed in the race, if not by competitors in one's own country then by competitors in the vastly larger economic units of the United States and of Russia.

The ratio between development costs and the price of the unit product is staggering. The suggestion has been made that the figure may be as high as sixty times. In this connection it is interesting to note that the American Convair 880 is to cost $3.3 million per aircraft. One hundred million dollars have been spent already on development and there is more to come. Even to produce a new mark of a given product costs some 10 per cent on turn-over in certain cases. No wonder there is much perplexity about the methods to be employed in paying for the development of the supersonic airliner which we shall have to see one day on the runway at Farnborough if the great air show there is to go on.

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Further down the line was the Handley Page Victor and as the Chief of the Air Staff, Sir Dermot Boyle, led his party to it they were greeted by Sir Frederick Handley Page who in his customary way was out on the field with his product though so lately returned from hospital and an operation to his eye. He received many congratulations on his recovery to health.

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*Farnborough First Report . . .*

# Varied Flying at Farnborough

OVER the years, the pattern of display flying at Farnborough has gradually changed. The number of prototypes has steadily decreased, so that fewer new shapes are to be seen in the air; but an increasing emphasis has been placed on presenting aircraft performing representative jobs, including larger-scale demonstrations by Service pilots and crews. Inevitably, new designs are confined almost entirely within the civil field, but their continued emergence indicates that the Industry is tackling the changing markets with characteristic vigour.

This year a thoroughly varied selection of aircraft types took the air for the 2-hr. display every afternoon, starting in brilliant "Farnborough" weather on Monday, which was a dress rehearsal for subsequent days. In general, the display times for most of the aircraft, which had appeared at previous S.B.A.C. shows, appeared shorter than in the past, although the few new arrivals were given suitably long periods for their characteristics to be appreciated. In some cases, however, the extra time was gained only by a simultaneous presentation with another aircraft from the same company.

At noon, as usual, the aircraft to be flown are separated from their ground-borne brethren in the static park and taken across to the other side of the runway for inspection and preparation, while the exhibitors' and the visitors' tents are occupied with their own traffic for lunch. Shortly after 14.00 hrs. the dispersal area presents a scene of renewed activity as the first pilots on the programme—bone-domed, *g*-suited and overalled—climb into their machines, and as the familiar voice of Oliver Stewart booms a welcome through the public-address system, an urgent undertone is added by the ascending wail of spinning turbines.

Soon the first aircraft creeps cautiously out to line up on the runway, to sit whistling quietly to itself, until precisely at 14.30, throttles are opened with a roar, brakes are releasd and the display programme for the 19th S.B.A.C. Show begins.

Opening item this year is the Scorpion-Canberra, Arctic-red wing tips and tail proclaiming its forthcoming winterization trials in Canada, and flown by T. E. Lampitt or H. K. Cartwright. Taking off from the opposite end of the runway from the crowd after a brief run, the Canberra stands on the twin spears of its Double Scorpion straight up into a roll off the top, showing the benefit to acceleration and climb of the additional thrust. The "Eversharp" nose of another Canberra following it, and performing an upward roll in the hands of John Squier, indicates the first public appearance of the radar-training T.11, which carries two pupils in addition to a crew of two for instruction in airborne interception.

With its two 4,500-s.h.p. Rolls-Royce turboprops, the Tyne-Ambassador test-bed demonstrates that it has power to spare, and flown by H. C. Rogers, is continuing the useful work which this particular machine began when it started its experimental career with two Proteus engines. In a new guise, the bulbous-bellied Gannet AEW.3, which was intensively flown since first becoming airborne less than two weeks before the Show, and has additional power from its A.S.M.D.8 (Mk. 102) as well as extensively modified contours, shows the same single-engined capability in the hands of Roy Morris, and lands quite happily with one airscrew feathered. Its undercarriage has been considerably extended for radome ground clearance, and requires much more pre-shortening for retraction than in earlier Gannets.

Vulcans feature prominently in this year's programme, and the first to appear is the Conway-engined test-bed, now fitted with four 17,250-lb. R.Co.11s. Its pilots include A. J. Heyworth, A. R. Barnard, A. C. Bavin and K. R. Sturt.

This is also a memorable year for helicopters, and several new turbine-engined designs are included in the display "circus," in addition to older piston-powered types. The shapely Bristol 192 hums quietly round in the hands of "Sox" Hosegood, who also demonstrates its single-engined performance after landing to have the ventral intake for the rear Gazelle blanked off ("positively no deception"); and equally impressive is the smaller Saunders-Roe P.531. This is agilely demonstrated by Ken Reed, in company with John Jeffery and R. Plenderleith in two Skeeters—a Mk. 12 for the British Army and Mk. 51 for the German Navy.

John Morton, in the Fairey Ultra Light helicopter, is performing a series of take-offs and landings from a platform built on a lorry moving at 10-15 knots, to simulate a naval frigate. During this performance, the massive and skeletal Westland Westminster taxies out on its big Bristol Freighter wheels, to show its ground manœuvrability, and then gives a most impressive display of confident handling. "Slim" Sear takes off backwards, and throws the great framework quietly but vigorously around the sky, and finally rears up almost vertically in a spectacular quick stop. He is followed by Roy Bradley, Derek Colvin and John Fay in a beautifully co-ordinated display in the Wessex (with over-the-vertical stalled turns), Whirlwind 7 and the Widgeon, and rejoins them for a spectacular final hovering formation, in stepped-up echelon, in front of the President's tent.

Sleek in their glossy camouflage, the seven Sea Hawks of the No. 800 Squadron R.N. aerobatic team have meanwhile lined up for their formation take-off, led by Lieut. Cdr. N. P. Perrett and with plenum chamber doors agape and a simultaneous fluttering of tested power controls, thunder off down the runway. The rear Vic appears to get a rough ride in the jet efflux of the lead aircraft, but not so rough as one individual on Monday who had a

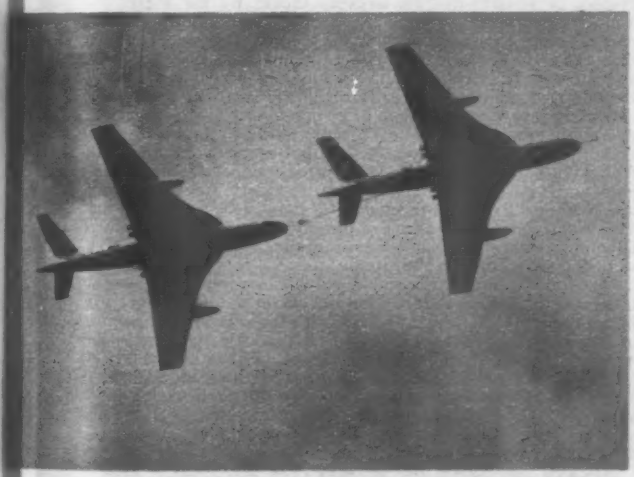
Left, the Supermarine Scimitars of No. 803 Squadron, R.N., supplied a brilliant addition to No. 800 Squadron's Sea Hawk aerobatics.

*Photographs copyright "The Aeroplane"*

One of the most potentially interesting aircraft on show was the Fairey Rotodyne VTOL airliner, here seen flying with wheels retracted.

fire warning after the first formation loop. Black smoke from his aircraft slashed across the red, white and blue trails left by the formation as he suddenly broke away, and headed towards the diversionary area of Blackbushe.

Those of the crowd who watched him saw a small blob detach itself at about 1,000 ft. as he ejected, and as the parachute developed safely the pilotless aircraft climbed increasingly steeply until it finally spiralled to earth. After a brief pause to re-form, the Sea Hawk team continued their show in the best



Linked by their flight-refuelling gear, two Vickers Valiant BK.1s formed part of the R.A.F.'s demonstration.

Service tradition, co-ordinated with the Scimitar team of No. 803 Squadron, which had swept across the airfield from the opposite end of the runway as No. 800 Squadron began to take-off. The six Scimitars flashed low overhead, cocooned in vapour and with a stunning crescendo of noise, and four performed formation aerobatics in a compact box.

A single Scimitar then provided the first significant tactical demonstration of the programme by executing a simulated attack path for nuclear weapons, or a L.A.B.S. pattern. Streaking low over the airfield, at just under sonic speed, the Scimitar pulled up into a wing-tip-vorticed climb, in which the weapon would be released, before continuing over into a half-loop, with a subsequent half-roll recovery.

Apart from the prospectively civil future demonstrated by the helicopters such as the Westminster and the Rotodyne, the transport contribution to the flying display is comparatively meagre. Only half a dozen of the aircraft can be considered to be transport types and these include such old friends as the Hunting President, the Scottish Aviation Twin Pioneer and the D.H. Beaver 2. Another old friend, the Bristol Britannia (a B.O.A.C. Mk. 312), is not flying this year, but is content to be inspected in the static park. Which is as it should be.

Transport newcomers include the D.H. Comet 4, the Vickers Viscount 810-Series and—in its clipped-wing 4B prototype form—the Comet 3B prototype. The Viscount is one of the 812s (actually the ninth) for Continental Airlines and the Comet 4 is the first of this mark for B.O.A.C.

Flown by John Cunningham, the Comet took part in the flying display on Monday and Tuesday and was due to be shown on the ground and in the air on the following day. By the time this report appears, however, it will have returned to Hatfield to be prepared for its proving flights to Hong Kong and, later, to Canada. The Comet 3B, flown by Pat Fillingham, shows off the thrust-reversers of the two outboard Avons in a comfortingly short landing. It is now in B.E.A. styling and somehow looks quite unlike its earlier self—even without its shorter span.

The Viscount 812, flown by "Jock" Bryce and E. B. Trubshaw, has the brilliant but practical Continental interior with 52 seats, four-abreast, in the main and forward compartments, and an aft lounge. Determined to lose nothing in the way of propaganda, Continental call it the Viscount II, give it "jet power" and ensure, with a neat little symbol, that everyone knows that it is radar-(that is, weather-mapping-radar) equipped. The maximum gross weight of the 810 Series, incidentally, has now been raised from 69,000 lb. to 72,500 lb.

The President was flown by Barry Radley and the Twin Pioneer—which disappeared after its demonstration on the first day and landed, after a cruise round the countryside, much later in the programme—by N. J. Capper.

R.A.F. participation begins brilliantly with a mass of aircraft heading low towards the airfield, and these suddenly rear up to reveal no fewer than 22 Hunters performing a perfectly aligned loop. To impeccable flying, No. 111 Squadron, led by Sqn. Ldr. Roger Topp, have added refreshing originality, and after another full squadron loop, three aircraft peel off from each side leaving a 16-man team to perform an equally impressive roll. These, of course, are unprecedented numbers for such manœuvres. A further separation leaves nine Hunters for another loop, followed by a bomb burst, with smoke, by four of these, after which the five-man team goes on to complete its well-known and beautifully executed performance.

Bomber Command's contribution comprises a V-bomber formation of Vulcan, Valiant and Victor, from Nos. 83, 90 and 10 Squadrons respectively, followed by two wing-tanked Valiants in

Picture shows a characteristic attitude and the split tail airbrakes of the Blackburn NA.39.

Photographs copyright "The Aeroplane"

# *Farnborough First Report . . .*

a flight-refuelling demonstration. The leading Valiant tanker has its bomb-bay doors open to expose the tanks and F.R. gear. A formation fly-past of Canberras is followed by the team of Jet-Provost 1s from C.F.S. led by Flt. Lt. D. Giffin, which use underwing smoke containers for their final loop, and the concluding Service items are two formations of 45 Javelins and 45 Hunters.

A refreshing contrast is provided by the light aircraft element, which is regrettably rather small. Ranald Porteous returns with his delightful aerobatics in the Auster Aiglet Trainer, including the usual inverted flick roll, while Jim MacMahon, of Crop Culture, demonstrates the efficiency of the Micronair spray atomizers on a J.5L Alpha. These new devices can be compared in action with the well-tried spray-bars fitted to the D.H. Chipmunk 23, which is loaded up from a tank vehicle on the runway before take-off. Pilot is Geoff Pike.

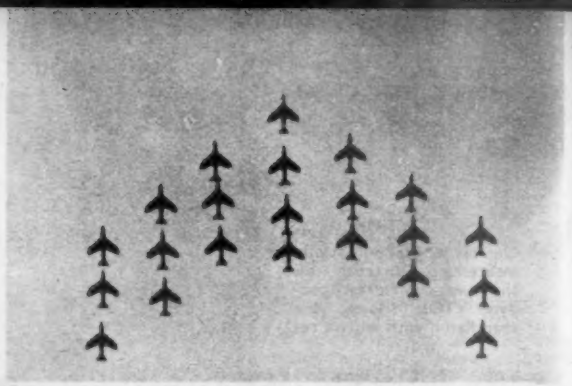
After the vigorous aerobatics of Dick Rumbelow or John Burns in the Jet Provost 2 demonstrator with its Viper A.S.V.11 engine, the more stately progress of the Fairey Rotodyne is a reminder of the importance of this VTOL airliner. To get the necessary 8 min. to demonstrate all phases of its flight, it is flying at the same time as the F.D.2, which Peter Twiss or J. Mathews is piloting, and is appearing for the first time in public. Flown by Ron Gellatly and John Morton, with Dr. D. Leason and A. Blower as flight test observers, the Rotodyne is taking off with its pressure jets ignited (at some 4 decibels lower noise level with

The P.531 helicopter by Saunders-Roe made an impressive debut at Farnborough.

the aid of sound attenuaters), retracting its undercarriage and climbing away to about 1,000 ft. There, at about 100 knots, the pressure jets are switched off and the auxiliary compressors declutched, leaving the lightly loaded rotor windmilling.

An interesting point is that in its cruising runs on Elands alone over Farnborough, the Rotodyne is flying daily at more than 20 m.p.h. above the current World helicopter speed record of 162 m.p.h. It is very quiet as a gyroplane, in which configuration it climbs quite rapidly, before returning to 1,000 ft and 100 knots to transfer the power to the rotor (accompanied by brief halos of kerosene vapour) and make a normal helicopter landing, with a last-minute extension of the undercarriage.

Both tactical and interceptor versions of the Folland Gnat are being demonstrated by Sqn. Ldr. Ted Tennant, Sqn. Ldr. S. Das.



One of the most beautiful demonstrations of clean and precise aerobatics ever given is put on by the 22 Hawker Hunters of "Treble One" Squadron led by Sqn. Ldr. Roger Topp.

I.A.F., and Mike Oliver, and orders for this versatile and economical type now total 73 aircraft, including the 14 R.A.F. trainers. Even with external stores, the Gnat's roll of 150°/sec. or so is as much as can comfortably be used, and the underwing tanks do not prevent transonic flight. At the other end of the fighter scale, the Gloster Javelin 8 with Firestreaks is showing, in the hands of Wg. Cdr. "Dickie" Martin, Peter Varley or Geoff Worral, the benefit of reheat for this heavyweight interceptor.

The Hawker team, varying between Bill Bedford, D. Lockspeiser, Don Lucey, Hugh Merewether and Duncan Simpson, get the utmost out of the Hunter F.6, T.7 and T.8, all with external stores, while keeping within the M.o.S. ban on supersonic flight, and Jock Elliot or Chris Capper are managing equally well with the D.H. Sea Vixen. The underwing Firestreaks and Microcell pods obviously do not noticeably slow the state of roll.

One of the highlights of the afternoon is undoubtedly the display of nuclear-weapon delivery tactics by the Victor and Vulcan. John Allam, in the tanked and probed Victor, brings his massive charge over the airfield at about 1,000 ft. before boring inexorably up through fragments of cloud, until the great white aircraft can be seen on its back directly above the runway. Incredibly, as the nose drops through, the Victor is gently half-rolled out into a shallow dive to complete this highly significant operational manœuvre. The Vulcan 1, flown by James Harrison or Tony Blackman, goes into the L.A.B.S. manœuvre immediately from take-off, and on Monday repeated the aileron turn after a half-loop. Air-brakes were used to restrict the recovery speed, and remained extended throughout a nose-high "delta" landing. The Vulcan 2 makes good use of the extra power from its uprated Olympus engines, and performs an upward roll from take-off, as well as a casual roll in the circuit.

On Monday, the Blackburn NA.39, which everyone was waiting to see for the first time, arrived in the circuit but did not perform because of an R/T failure, the aircraft's radio becoming jammed in "transmit." It has since shown off its distinctive Area-ruled lines in fly-pasts from Boscombe Down. Flown alternately by Lieut. Cdr. D. J. Whitehead and "Sailor" Parker, the trim blue-and-white NA.39 being brought in very fast at low altitude to show the type of tactics it will employ operationally. It made a slow roll, and then a slow run with airbrakes, flaps, and undercarriage extended, probably using boundary layer control.

Another non-starter on Monday was the English Electric Lightning, but this has provided an effective finale for subsequent displays, in the hands of the inimitable "Bee" Beamont, or the R.A.F. Project Officer for the P.1, Sqn. Ldr. James Dell. Both of the Lightnings which are exhibited at Farnborough have the taller fins, which add nearly 30% more area for directional stability, and carry the ventral fuel tank as an alternative to the Double Scorpion rocket pack. That in the static park carries two Firestreaks. The thunderous reheat roar of their two R.A.24R. turbojets provides a fitting climax for a display brilliant with technology as well as consummate flying skill.—J.E.F.

Both the Westland Westminster (left) and the Wessex gave spectacular performances, the latter appearing frequently to be almost on its back during steep stalled turns.

*Photographs copyright "The Aeroplane"*

*Farnborough First Report . . .*

# Missiles at the Show

ONCE again dominating the main approach to the static exhibition marquee, the outside guided weapons "park" this year is far from being a static display. While, perhaps, there is not such a variety of units to look at this year as there was in 1957—and there is a most disappointing absence of any indication of the really advanced research vehicles such as Black Knight for re-entry investigation—the accent on production weapons and operational practice comes as a welcome change from the development emphasis of previous displays.

For example, in three cases, Service teams are demonstrating the ease with which the weapons can be prepared for action. And in each case, the smoothness of the operation suggests that the new generation of anti-aircraft weapons, whether air- or ground-launched, are no more difficult to handle than their less sophisticated forerunners.

Generally speaking, the guided weapons exhibits as a whole are more comprehensive than in previous years and there is plenty of evidence of more sympathetic Security treatment so far as display is concerned. But once more one finds that the amount of actual information made available to the enquiring visitor is still very restricted

As an example of the sort of Security anomaly that one almost always finds at Farnborough—while the Avro stand-off bomb is only permitted to make the briefest of visits, carried under a Vulcan passing over during the flying display, the company's section of the Hawker Siddeley Group stand has as its most dominating exhibit an "air launched aerodynamic test vehicle" which bears a most striking resemblance to the actual weapon. And just so that the comparison can be made more easily, alongside is a smaller wind-tunnel model and a relatively large model of a Vulcan carrying the bomb underneath it.

Differences between all these are clearly discernible, but the family likeness is strong enough to make restriction to such a tantalizing glimpse of the weapon in the flying display a little difficult to understand. The large test vehicle shown is, at a guess, something less than half size—perhaps a 2/5th scale. Sizeable panels are replaced by Perspex so that some of the internal arrangements may be seen—although, it might be added, the "high altitude" at which the model is displayed successfully reduces the effectiveness of one's studies to a minimum.

At the forward end can be seen the actuating gear for the noseplanes which act as elevators. These are sharply swept at about 60° and are truncated deltas. The rear upper and lower fins and the tailplanes are similarly shaped but with the vertical surfaces set farther back than the horizontal ones. On these tail surfaces there appears to be a small tapered rudder on the top fin and a rectangular inboard aileron on both horizontal surfaces. In the body of the vehicle behind the nose control compartment there would seem to be the usual collection of electronic units and power-service packs.

Seen en passant during the flying display, the stand-off bomb carried under the Vulcan has its under-fin folded sideways to avoid adding to the aircraft's fin area.

Two jet orifices are to be seen at the rear end which would appear to line up with the reported twin-Spectre powerplant of the actual weapon. In the model, however, it seems unlikely that liquid rocket units are used and what appears to be a large fuel tank is more than likely a single solid rocket motor feeding two nozzles. The smaller wind-tunnel model displayed on the stand has four jet orifices but otherwise a similar configuration.

One noticeable aerodynamic difference among all these examples of development stand-off bomb layouts is that whereas both large models have "straight" rear wings with no dihedral, the small one shown under the Vulcan model and the full-scale one in the flying-display Vulcan have a distinct anhedral over the outer third or so of the wings. Similarly it is shown with its rear under-fin down whereas the yellow-painted weapon carried under the Vulcan in the flying display was folded sideways in the flying position.

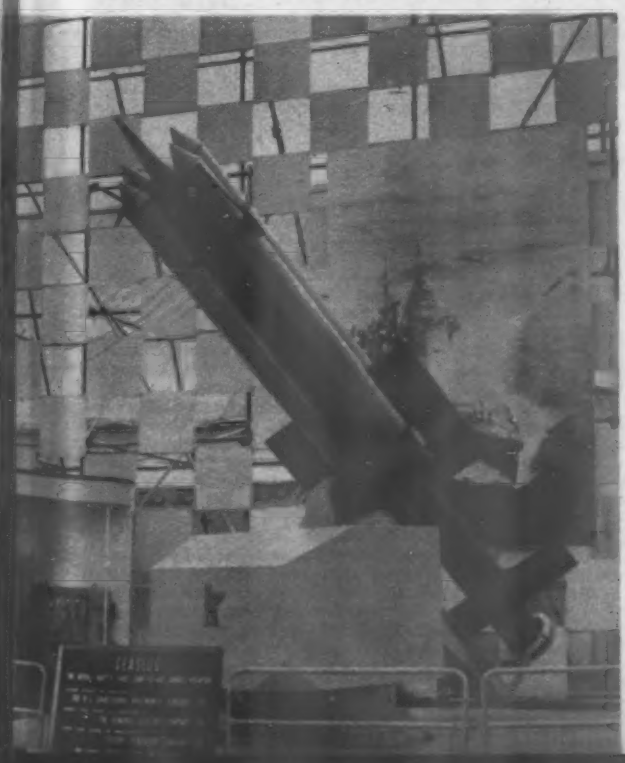
Pride of place at the head of the approach steps in the outside park is enjoyed by the ramjet powered Bristol/Ferranti Bloodhound surface-to-air weapons, which is intended as the principal area-defence missile for the U.K. and is in production for the R.A.F. As shown in the enclosure the weapon is mounted on its transportable launcher unit—the limber for which is shown also. These launchers are said to need a simple form of prepared base but they can be dismantled or set up in a relatively short time.

The missile is carried to the launcher on a loading trolley after being checked and made ready for firing. Just how simple a matter it is to transfer the prepared Bloodhound from the loading trolley to the launcher and elevate it in readiness for firing is demonstrated most efficiently by a six-man R.A.F. team.

To complete the operational picture in the enclosure is a launch control-post van. One of the features of Bloodhound is that it is a complete weapons system which includes a B.T.H. target-illuminating radar. All the equipment involved has been made readily transportable.

A semi-active homing system such as that used for the Bloodhound, offers many advantages, not the least of which is a greater degree of simplicity in the missile itself. Moreover, a single target-illuminating radar can be used in conjunction with any number of missiles which can be fired singly or in salvos as required. In this connection, some idea of the layout of a Bloodhound battery is to be found in the inside exhibition on the Bristol stand where a small model shows a possible arrangement of 12 missiles on their launchers.

Designed originally for the Army and later ordered also for the R.A.F., the English Electric Thunderbird is another large surface-to-air weapon using a semi-active homing system. Here again the missile is displayed as a Service unit with its associated equipment. It is mounted on a mobile launcher used in conjunction with a loading vehicle and the complete sequence of setting



Seaslug is to be seen for the first time with four single boost rockets in place of the earlier four triple clusters.

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up the launcher and transferring the missile to it is done "at the double" by a seven-man Royal Artillery team.

Thunderbird is powered by a single solid-propellant main sustainer motor. Already there is mention of the use of improved propellants with corresponding increases in the missile's speed and range. The specific impulse of the solid propellant can be raised by the introduction of light metal to replace some of the carbon atoms. As an indication of the effect it is said that increasing the specific impulse by 10% gives a 30% increase in propulsion range—i.e. before all-burnt.

As in the case of our other ground-based surface-to-air weapon, the Thunderbird system has been made fully mobile and can be carried in existing Service transport. On the company's stand inside the main exhibition tent there is a most interesting model of a "field assembly and test point" which lays further emphasis on this mobility.

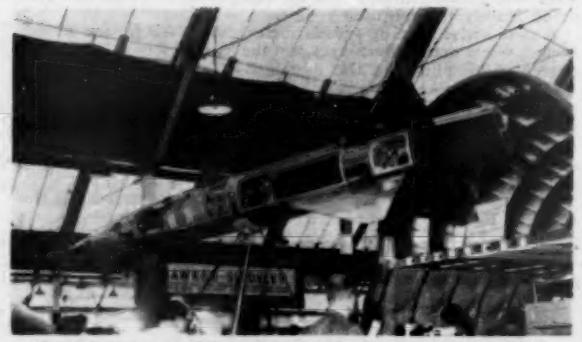
While still in the container the missiles are functionally tested after which they are removed and have the warhead, wings, control fins, and radomes added to them. Meantime the boost units have been made ready and these are fitted just before the now complete Thunderbirds are placed on the launcher loading trolleys and taken to the "ready use" area.

Another dominant surface-to-air weapon in the outside park is Armstrong Whitworth's Seaslug for the Royal Navy seen for the first time with its new single-unit boosters. Whereas previously the development rounds of Seaslug seen "in the flesh" or in photographs had a massive booster system of four triple-rocket clusters this, presumably, production type has the more conventional arrangement of four single units. These are interesting also for their conical nose caps which are not chamfered to aid separation as was the case with the previous triple units.

A close-up of the forward attachment of the Seaslug's new booster units.

It has now been confirmed that the production-type Seaslug is powered by a solid-propellant sustainer rocket. Earlier development units were powered by liquid rocket engines using nitric acid and methanol.

A five-man team from the R.A.F.'s Guided Weapons Development Squadron is demonstrating the operational handling procedure of Fairey's Fireflash air-to-air weapon which is used for operational training by the R.A.F. An airfield test set feeds a simulated command beam into the guidance system and appropriate meters show how the various circuits respond. For testing the control circuits, the missile is physically moved and the response of the gyros is checked electronically and by observation of the control surface movements. The explosive portions of the missile are tested separately in a different location.



Described as an air launched aerodynamic test vehicle this Avro exhibit bears a close resemblance to the stand-off bomb.

*Photographs copyright "The Aeroplane"*

In the latest Thunderbird, there are now no fairings at the wing roots.

After checking, the two booster rockets are assembled on a special trolley with the warhead-part of the missile located between them. By the time this is finished the control and guidance portions of the Fireflash are ready for assembly to the remainder and when this is done the whole unit is ready for transport to the aircraft and attached to it.

It is interesting to note, on the Fireflash display that among the number of missiles on show is one version with a noticeably larger wing area, presumably a development unit for high-altitude operation.

This year the D.H. Firestreak does not appear in the outside guided weapons park. However, as befits the standard air-to-air weapon selected for the R.A.F. and the Royal Navy, it is to be found, if not in profusion, at least in comparatively large numbers around the aircraft displayed and also in the static exhibition. The Firestreak, using an infra-red homing head, is powered by a single solid-propellant rocket motor. Various items of its internal equipment and some of the associated systems are to be found on various stands in the big marquee.

Sole representative of Britain's missile research effort is the Short/Elliott G.P.V. (general-purpose test vehicle) shown this year in its recoverable form complete with flotation bag and parachute system. The latter is a two-stage affair by G.O., the first stage being a cluster of three small canopies and the main parachute being a large single unit.

A time clock is preset to give the required start to the recovery sequence. This first releases the three small parachutes which checks the round's rate of descent. This is followed by an explosive charge which controls a jack ejecting a panel over the main parachute container in the front portion of the vehicle; the cable for the parachute is attached to a point near the rear control fins. In the same compartment as the main parachute is a flotation bag which is inflated by $CO_2$ bottles triggered off by "sea cells" which close an electrical contact when they come into contact with the water. This bag not only supports the round in the water; it acts also as a marker to assist retrieval.

Powered by a liquid-propellant rocket engine the Short G.P.V. has been used in some considerable numbers for guidance and control system research using equipment designed by Elliott Bros. (London), Ltd. In this latest version the homing head is a Mk. 3 unit which is noticeably more compact, and presumably much lighter, than the Mk. 2 version seen last year. Rounds with these new homing heads have not yet been fired.

Another Short contribution to the guided-weapon business is to be seen on the company's main stand. This is the little SX-A5 surface-to-air multi-purpose test vehicle that has formed the basis of the small shipborne guided weapon now being developed by Shorts for the Royal Navy. No details of this weapon have been released but it can be stated that it is intended to replace the 40-mm. gun that has been the Navy's standard close-range weapon for some years.

The SX-A5 was, in fact, shown at Farnborough last year. It is propelled by a solid rocket, and extensive firing trials have been made with it.

Although hardly within the scope of an aeronautical weapons display, the two small anti-tank infantry missiles shown by Pye and Vickers-Armstrongs are, nonetheless, interesting. Although primarily designed for surface-to-surface use there would presumably be no insuperable difficulties in employing them in an air-to-surface capacity for, say, a helicopter. Both these weapons are private ventures and both employ a visual command link guidance system.

A third anti-tank missile—the newly announced Fairey weapon—is present only in name and announced both on the company's stand and on their Fireflash exhibit outside. Apart from a statement that this weapon has been selected for the Army no details are available, but it is believed that its range and hitting power are greater than those of other comparable units.—F.T.M.

# Engines on View

*Photographs copyright "The Aeroplane"*

Above, developed from the Rolls-Royce R.B. 108 for the Short SC.1, the R.B. 145 is a small turbojet which evidently has a very high power/weight ratio: probably about 8 : 1. Thrust is 2,750 lb.

Right, this is the latest impression of the R.B. 141, 12,000-lb. thrust by-pass turbojet for the D.H. 121, shown by Rolls-Royce, Ltd. Said to have a specific fuel consumption and a noise-level much lower than any existing engine of similar thrust without using noise-reducers, the R.B. 141 closely resembles the Conway.

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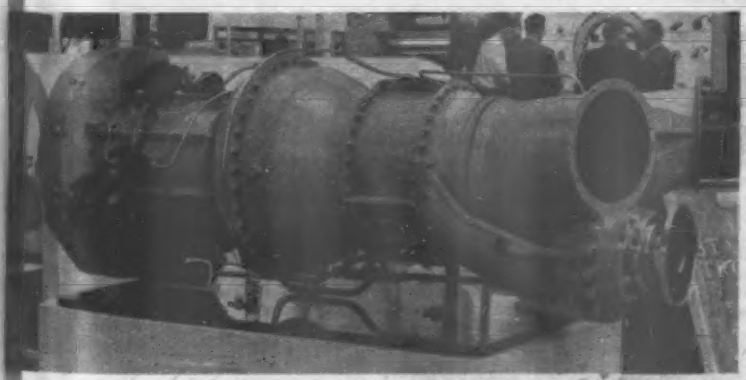
Above, smallest engine at Farnborough is the tiny PR.23 liquid-propellent rocket of Armstrong Siddeley. This has a thrust of 500 lb. and is suitable for use as a trimmer for ballistic missiles or for correcting trim of an aircraft in certain conditions.



Above, latest Blackburn engine is the A.129 shaft turbine of 840 s.h.p. which ran for the first time just before the Show opened. Based on an Artouste, the A.129 has two stages of axial compressor blades upstream of a final centrifugal stage. Power output is from a free turbine and a Turmo gearbox.

Right, turboprop version of the new 1,100-s.h.p. Armstrong Siddeley shaft turbine is the P.182. It has a gas generator section common with the P.181 helicopter engine also shown by Bristol-Siddeley Engines, Ltd.

*Farnborough First Report*

# New in the Static Show

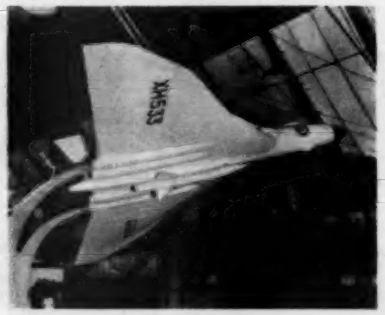
FROM the large number of exhibits shown in the indoor and outside displays at this year's show there is a varied range of new items as well as developments to older equipment. And there are several companies exhibiting for the first time.

Among the new aircraft components is the **Goodyear** trimetallic disc brake for the Vickers 810-series Viscount. The company is also showing for the first time at Farnborough its new skid-warning system, including the "foot-thumper" mechanism for attachment to the pilot's brake pedal.

A new air-circulation oven with three-heat control can be seen on the **General Electric Co's** stand. Capable of dealing with 30 meals per loading, this catering unit has been developed for the Scandinavian Airlines System. The G.E.C./Vickers 28 V. DC transistor-operated fluorescent lighting system for aircraft is also demonstrated by two units. One for operating 3 ft. or 4-ft. tubes at a low brightness, and the other working from 115 volt 400 c.p.s., for operating 4-ft. tubes at the same brightness as the transistor system; the use of the transistor system allows the interior to be illuminated while the transport is on the ground.

**Rotax, Ltd.,** is displaying an oil-cooled rotating rectifier brushless alternator rated continuously at 40 kVA at 8,000 r.p.m., and at 15 kVA ram-air turbo-alternator. This latter unit is designed to provide emergency electrical power, and comprises a 16-in. dia. nacelle in which is housed the alternator driven by a variable-pitch 14-blade turbine. The company is also exhibiting a new range of AC switchgear for 208 volt operation.

The latest types of powered flying controls and fuel simulator units are displayed on the **Hobson** stand. These include a tandem piston-type hydraulic jack for rudder control in a high-speed fighter, elevator and rudder control artificial feel units, flap actuators and turbojet reheat control-system components. New hydro-mechanical constant-speed alternator drives are also shown by Hobson.



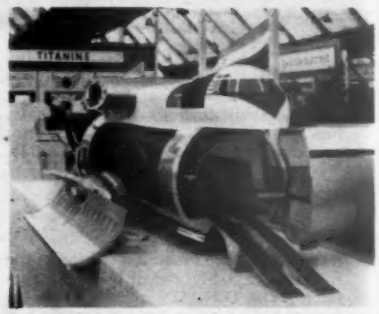
Dominating the Avro stand is this model of the first production Vulcan 2, carrying the Avro stand-off bomb.

New heavy-duty halo-ring universal joints are on the stand of the **Mollart Engineering Co., Ltd.** Extending the company's range of such joints, these units are specially designed for aircraft control systems where torques up to 60 ton in. are required to be transmitted. **Chloride Batteries, Ltd.,** is demonstrating solar active cells used for the re-charging of small orthodox batteries in space satellites.

Developments in ground servicing equipment cover a new range of aircraft jacks by **Skyhi, Ltd.** These consist of a heavy-duty tripod wing jack, which can be either individually powered or operated as a set of jacks from a control console, twin-wheel change double-ram jacks for use on a bogey undercarriage in conjunction with stub axles, and a 3-ton tripod jack for use with lighter aircraft with low ground clearance.

On the **Avery-Hardoll** stand there are two new items. The first is automatic bottom-loading equipment for aircraft refuellers which includes a quick-release self-sealing coupling, a high-capacity automatic foot valve, a visible indicator and outward vent valves. The second unit is a high-level shut-off valve for fuel storage tanks which, in its standard form, has a capacity of 833 Imp. gal./min. and is designed to function on long pipelines, with pump by-pass pressures in the region of 120 p.s.i.

Models of the Airco D.H.121 appear on the stands of de Havilland, Fairey and Hunting—the three companies concerned with its development.



Blackburn show a model of their B.107A proposal which the War Office would like to see ordered as a Beverley successor.

Two 400 c.p.s. ground servicing sets for use with aircraft with AC electrical systems can be seen on the stand of **Houchin, Ltd.** One is the integrated servicing trolley Mk. 1 for aircraft with 112-volt DC, 28-volt DC or 200-volt AC, 400 c.p.s. electrical systems, and the second is the Houchin HY-CY trolley for servicing aircraft with 200-volt, 400 c.p.s. AC and 28-volt DC systems.

Among the new exhibitors this year there is **Coin Insulators, Ltd.,** showing laminated synthetic resin-bonded materials and components demonstrating the machineability of such products, and **Metachemical Processes, Ltd.,** displaying Dalic plating equipment and aircraft components incorporating micrograin nickel plating. The **Aircraft Research Association, Ltd.,** has a 1/12th scale model of the working section of its transonic tunnel and other models on show.

Signs of vigorous attempts to deal with to-day's problems in air traffic control and of means of improving instrumentation—and, in particular, of heading information—were to be found at this year's exhibition. Additionally, the visitor is shown, if only in a limited way, that the U.K. had not been without a programme in the inertia navigation field.

Air traffic control re-thinking was to be found, for instance, in the demonstration of a possible radar data handling technique by **Marconi** and in the **Kelvin Hughes** system of rapid photographic processing of radar displays. New ideas in instrumentation are to be found on the **Smiths Group** stands, where a rather more than "breadboard" model of their precision altimeter is shown, with a type of presentation—using a single 1,000-ft. dial and a two-figure counter—which shows the trends of to-day.

On this series of stands, too, can be seen the new K.H. precision directional gyro, while **Sperry** showed the U.S. company's development of the Rotorace system. Both these gyro heading indicators, whether used in conjunction with a compass system or not, are designed to provide headings which have an accuracy of the standard necessary for present-day airline operations and for use with Doppler navigator equipment in which the primary need is for reliable heading information.

Although American work on inertial navigation systems has been publicized during the past two years or so, little or nothing has been said about work which has been going on in this country. For the first time something of this work was shown—on the Sperry stand, where a necessarily somewhat ancient piece of inertial equipment is exhibited. These inertial systems have been flying for four years—just as the K.H. rapid-processing photographic system has also been under development for much the same period of time. Interesting though they are, inertial systems are of primary value for guided weapons, and it has apparently been necessary to keep quiet about British work in this field.

Although, this year, there is an immense amount of navigational aid and electronic equipment to be seen in the "big tent," there is much more to be seen than before in the outside equipment exhibition.

*Photographs copyright "The Aeroplane"*

*Farnborough*

*First Report . . . .*

# Points from the President's Speech

MR. AUBREY BURKE, President of the S.B.A.C., after welcoming the guests from 120 different countries and territories, went on to make a number of significant points in his speech at the S.B.A.C. on September 1.

* * *

S.B.A.C. stands for more than Society of British Aircraft Constructors. It also stands for Selling British Aircraft Continuously.

* * *

S.B.A.C. export business continues to expand. In the 13 post-war years members have exported £720m. worth of aeroplanes, aero engines and components. Last year's figures show a 1,000% increase over the 1946 figures; engines increased by 3,200% over the same year. These spectacular increases brought in £116½m. of foreign currency during 1957, and this year are even better. It looks as though the figure for 1958 will be over £150m.

* * *

Members of the S.B.A.C. could not afford to sell these aircraft, guided weapons, engines and equipment, at the prices the customers pay for them, were it not for the substantial orders received from the British Military Services and State Airlines. Members rely on them a great deal; first, for the operational information on which a specification is drawn up; secondly, for the production orders which help to recover the cost of design, development and tooling; thirdly, for the initial proving when they enter service; and fourthly, for operating them so effectively and demonstrating their qualities when they enter regular service.

* * *

The whole burden of the pioneering job of introducing turbine-engined transports to the airlines of the world has been borne by the aircraft industry of this country for the past 10 years. Naturally we had our troubles and naturally there were people who made them out to be worse than they were.

* * *

British turbine-engined transports are now being operated by 53 separate operators in 33 countries and are building up experience, on top of the already achieved 1,500,000 flying hours, at the rate of about 70,000 hours per month. This figure will increase steadily month by month. Some individual aircraft have already done 10,000 hours of intensive operation, and engines have achieved an overhaul life of 1,800 hours and a standard of reliability such as has never been known with piston engines. Nowhere else in the world can turbine-engined transports with such a background of civil experience be bought as in this country.

* * *

It has been suggested that there should be some sort of control on the rate of introduction of new types of transport aircraft, because the ones they are replacing are not fully amortized. Others who calculated the economic advantages of buying turbine-engined aircraft and ordered early are reaping a rich reward and, in some cases, have sold their old aircraft at prices in excess of what they paid for them. Such is the way progress is made and no artificial controls should be introduced to retard it. On the contrary we should do everything we can to improve our aircraft and make air transport a more efficient and cheaper form of travel.

* * *

As this country is one of the most densely populated parts of the world and doesn't enjoy the best of flying weather it would seem appropriate that it should take the lead in developing the VTOL and STOL forms of transport. In these types of aircraft we can see the beginning of the answer to the problem of how to transfer traffic from surface travel to air travel on the shorter journeys. Here is an enormous potential market waiting to be tapped. If we are going to capture it large sums will have to be spent on research and development before the equipment can operate competitively with other means of surface travel.

* * *

We have spent 50 years and a vast sum of money in developing the aeroplane as an instrument of war. What enormous strides we could make if we could have the same time and money devoted to perfecting the aeroplane as an instrument of peace. No doubt this thought was in the mind of Her Majesty's Government when the Minister of Supply announced recently that, even though fewer manned aircraft would be needed for military purposes in the future, aeronautical research would continue broadly on the same basis.

* * *

A fleet of 100 aircraft of the 100-seater type could earn for their operators (calculated over a period of 10 years) an additional £10m. if by research into materials the total structure weight could be reduced by 1%. Similarly, a 10% increase in wing loading without the penalty of increased approach speeds would earn for them an additional £30m. A 10% reduction in engine s.f.c. would save about £100m.

* * *

A continued steady level of expenditure on research and development is absolutely vital to our survival as an aircraft manufacturing country.

* * *

If we could reach agreement on an international basis whereby hundreds of thousands of young people could be flown to foreign lands every year on a scholarship exchange scheme, the aeroplane could do more over a period of 25 years for world peace than has been achieved in the past 50 years.

* * *

To transport half a million students 14,000 miles per annum would require about 120 large aircraft. To move them this distance and keep them for two months would cost about £100m. To send a Sputnik round the earth carrying a pup or to take a photograph of the back side of the moon costs a great deal more.

*Photograph copyright "The Aeroplane"*

ALL-WEATHER FIGHTERS.—Gloster Javelins—a Mk. 7 on the left and a Mk. 8 with reheat on the right. Both have Armstrong Siddeley Sapphire turbojets.

*Farnborough*

*First Report . . . .*

# Airborne for Farnborough—1

NAVAL TRAINER.—Above, first airborne picture of the Hawker Hunter T.8 (Rolls-Royce Avon 200 Series turbojet), which is generally similar to the R.A.F.'s Hunter T.7 except for the arrester hook.

MISSILE ARMED.—Right, this English Electric Lightning F.1 (two Rolls-Royce Avons) is one of 20 pre-production aircraft for the R.A.F. It is seen here carrying two D.H. Firestreak air-to-air missiles.

FOR EARLY WARNING.—Left, the Fairey Gannet AEW.3, powered by an Armstrong Siddeley Double Mamba 102 turboprop, is the latest version of the Gannet and carries a large ventral radome.

FIRST B.E.A. JET.—Below, seen flying near Earls Court, is the D.H. Comet 3B, which is the prototype of the 4B, six of which are on order for British European Airways. It has four Rolls-Royce Avon 523 turbojets. This short-span short-haul version is to enter service in 1960.

*Photographs copyright "The Aeroplane"*

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# Aircraft at the S.B.A.C. Show

**Aiglet Trainer.**—Auster Aircraft, Ltd. Model J/5L. One 145 h.p. de Havilland Gipsy Major 10/2. EP-AIJ. Production Aircraft for the Iranian National Civil Aviation Club with full six-instrument blind-flying panel and VHF. J/5L first flew Sept. 15, 1954.

**Alpha.**—Auster Aircraft, Ltd. Model J/1N. One 130 h.p. de Havilland Gipsy Major 1. G-APAR. Production aircraft for Crop Culture (Aerial), Ltd., with four direct-drive Britten-Norman Micronair atomizers beneath wings, replacing normal spray booms. Forty-five gal. chemical tank in rear cabin pressurized from ventral windmill pump. Swath coverage up to 30 yd. J/1N first flew July 1, 1955.

A new type of Britten-Norman Micronair rotary atomizer has been fitted to this Auster Alpha for crop spraying.

*Photographs copyright "The Aeroplane"*

**Beaver 2.**—de Havilland Aircraft Co., Ltd., D.H.C. 2. One 540 h.p. Alvis Leonides 502/4. G-ANAR. Company demonstrator, a Canadian-built Beaver fitted with the British Leonides engine and racks for underwing stores. First flew (Mk. 1), August 16, 1947.

**Blackburn NA.39.** — Blackburn and General Aircraft, Ltd. B.103. Two 7,000 lb.s.t. de Havilland Gyron Junior DGJ.1. XK486. First prototype of the Navy's new strike aircraft, in flying display only. First flew April 30, 1958. Second prototype, first flown in August, 1958, also on airfield for exhibition to "security-cleared" visitors.

**Bristol Type 192.**—Bristol Aircraft, Ltd. Two 1,650 s.h.p. Napier Gazelle N.Ga.2 shaft turbines. XG447. First of the turbine-engined derivatives of Bristol 173 family of tandem-rotor helicopters. Built on production jigs as part of a batch for the R.A.F. First flew July 5, 1958. Prototype has two positions for automatic observers in the cabin, and a wire-braced boom for pitot and yaw-meter heads extending from the nose.

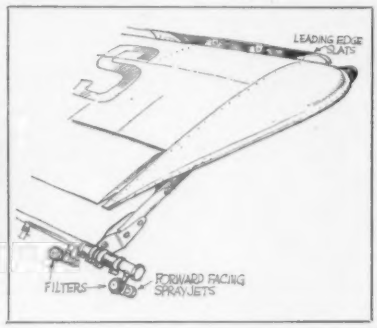
**Britannia 312.**—Bristol Aircraft, Ltd. Type 175. Four 4,210 e.h.p. Bristol Proteus 761 turboprops. G-AOVI. Standard B.O.A.C. production type, with new Proteus mark, in which the entry guide vanes have been re-angled and the rotor and stator blades are electro-polished. Aircraft flown to Farnborough by B.O.A.C. crew on Sunday. Britannia prototype first flew August 12, 1952; first 312 flew December 31, 1956.

**Canberra B(I).8.**—English Electric Co., Ltd. XM245. Standard production aircraft, with two 1,000 lb. bombs under wings and four alternative fuselage loads, comprising four 20 mm. cannon pack, six 1,000 lb. bombs, 16 by 4.5-in. reconnaissance and target flares and air skymarkers; and collection of practise bombs. Canberra 8 first flew July 23, 1954.

**Canberra U.10.**—Short Bros. and Harland. SC.4. Two 6,500 lb.s.t. Rolls-Royce Avon 101 turbojets. WJ624. Standard conversion of B.Mk.2 by Short Bros. as pilotless drone in guided weapon trials. First flew under auto-control, June 11, 1957. First Canberra to have Martin-Baker Mk. 4 lightweight automatic ejection seat for pilot.

**Canberra T.11.**—Boulton Paul Aircraft, Ltd. Two 6,500 lb.s.t. Rolls-Royce Avon 101 turbojets. WJ610. Standard conversion of B.Mk.2 by Boulton Paul for use as radar trainer. Carries Javelin-type A.I. equipment in nose, and has additional wind-break door forward of the cabin entrance. First flew March 29, 1958.

**Chipmunk 23.**—de Havilland Aircraft Co., Ltd. D.H.C.1. One 145 h.p. D.H. Gipsy Major 10 Mk. 2 engine. G-APOS. Second conversion of ex-R.A.F. Chipmunk T.10 trainer for agricultural duties with Fison-Airwork. Redesigned fuselage with 14-cu.-ft. glass-fibre hopper for solid or liquid chemicals in former front-seat position. Full-span spray bars beneath trailing edge and "windmill" generator under fuselage. Fixed slats at wing tips. First flew June 6, 1958.




Special equipment for the agricultural D.H. Chipmunk 23 includes fixed tip-slats and spray-bars.

*Drawing copyright "The Aeroplane"*

**Comet 3B.**—de Havilland Aircraft Co., Ltd. Type 106. Four 10,500 lb.s.t. Rolls-Royce Avon 523 (R.A.29) turbojets. G-ANLO. The original long-fuselage prototype, now flying as a development aircraft for the Comet 4B with short-span (107 ft. 10 in.) wing, and thrust reversers on the two outer engines, exhausting above and below the wing centre section. Now in B.E.A. colours and named "R.M.A. Sir William Brooks." First flew (with Avon 522s) July 19, 1954; as Mk. 4 development aircraft (with Avon 523s) on February 25, 1957; and as the 3B on August 21, 1958.

**Comet 4.**—de Havilland Aircraft Co., Ltd. Type 106. Four 10,500 lb.s.t. Rolls-Royce Avon 524 (R.A.29) turbojets. G-APDA. First production Comet 4 on B.O.A.C. contract for 19. Furnished as trial installation to new B.O.A.C. standard and fitted with noise-reducers, but not reversers. First flew April 27, 1958.

Above, this Canberra T.11 has been converted from a B.2 by Boulton Paul Aircraft, Ltd., for radar training. The nose cone houses Javelin-type radar.

Left, the four 20-mm. cannon pack of the Canberra B(I)8 on its handling trolley.

# *Farnborough First Report . . . .*

**Conway-Vulcan.**—Rolls-Royce, Ltd. Four 17,250 lb.s.t. Rolls-Royce Conway R.Co.11 by-pass turbojets. VX770. Original Vulcan prototype re-engined as flying test-bed for Conways. First flew (with early Conways) August 9, 1957.

**Dove 6.**—The de Havilland Aircraft Co., Ltd. Type 104. Two 380 h.p. de Havilland Gipsy Queen 70 Mk.2 engines. G-AMZN. Company demonstrator fitted out as six-seat executive transport. Static park only. Dove first flew September 25, 1945; Series 6 flew September 25, 1954.

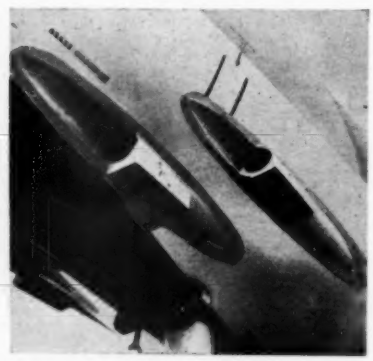
**Fairey F.D.2.**—The Fairey Aviation Co., Ltd. Type V. One Rolls-Royce Avon turbojet with re-heat. WG774. As exhibited in 1957. One-time World's speed record holder at 1,132 m.p.h. First flew Oct. 6, 1954.

**Gannet AEW. Mk.3.**—The Fairey Aviation Co., Ltd. Type Q. One 3,875 e.h.p. Armstrong Siddeley Double Mamba 102 (A.S.M.D. 8) turboprop. XJ440. First example of the new airborne early warning variant of the Gannet, which has a large ventral radome; new cabin amidships for two observers; short jet pipes, extra fin area and many other changes. First flew Aug. 20, 1958.

**Gannet AS. Mk.4.**—The Fairey Aviation Co., Ltd. Type Q. One 3,035 e.h.p. Armstrong Siddeley Double Mamba 101 (A.S.M.D. 3) turboprop. UA115. Standard production aircraft for German Kriegsmarine. Gannet first flew September, 19, 1949; first AS. Mk.4 flew March 12, 1956.

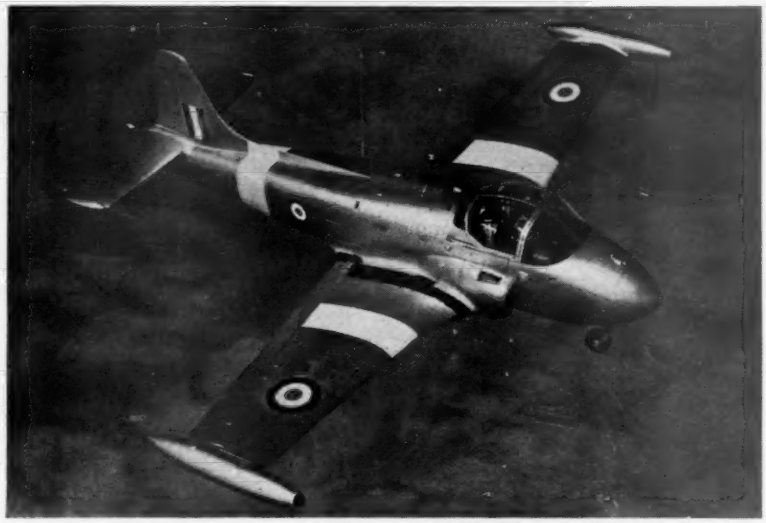
**Gnat 1.**—Folland Aircraft, Ltd. FO.141. One 4,520 lb.s.t. Bristol Orpheus 701 (B.Or.2). G-39-10. The third Finnish Gnat, to export standard as an interceptor, with two 30 mm. Aden guns, radar ranging gunsight and slab tail. Also XK741, the fourth M.o.S. Gnat flying in tactical role with two 66-gal. drop tanks and 12 x 3 in. air-to-ground rocket projectiles, and shown in static park with alternative underwing stores including two 500-lb. bombs, Mk.8 R.P. with 60-lb. heads and Matra CT10 3-in. R.P. First flew July 19, 1955.

**Heron 2.**—The de Havilland Aircraft Co., Ltd. Type 114. Four 250 h.p. de Havilland Gipsy Queen 30 Mk.2 engines. G-APEV. This is the Mk.2D, a custom-built executive type with fully feathering airscrews. Heron first flew May 10, 1950; Mk.2 Dec. 14, 1952.



A close-up of the new cannon ports on a Hawker Hunter F.6.

**Hunter F.6.**—Hawker Aircraft, Ltd. P.1099. One Rolls-Royce Avon 200-series turbojet. XF389. Standard production aircraft carrying two 100-gal. drop tanks and 24 x 3 in. rocket projectiles. Also XE618 in static park with variety of possible stores for the four underwing pylons, including on *each* wing, 12 x 3 in. R.P. with 18 or 25 lb. heads outboard and six inboard; four 3 in. R.P. with 60 lb. heads outboard and two inboard; one 100-gal. and one 230-gal. tank; four 37 x 2 in. Microcell rocket pods; four U.S. 5-in. H.V.A.R. rockets outboard and two inboard; two 1,000 lb. bombs, two 500 lb. bombs or two Napalm bombs in 100-gal. plastic tanks. Fairey Fireflash and D.H. Firestreak missiles. Also fitted with modified cannon ports with ventral louvres to eliminate pitch-down during gun firing at high altitudes and low



*Photographs copyright "The Aeroplane"*

The Hunting Jet Provost T.3 is in quantity production for R.A.F. Training Command. The third production aircraft is shown.

I.A.S. Hunter (P.1067) first flew July 20, 1951; Hunter 6 flew January 22, 1954.

**Hunter T.7.**—Hawker Aircraft, Ltd. P.1101. One Rolls-Royce Avon 100-series. XL564. Standard production Hunter Trainer for the R.A.F., with the "small" Avon engine and saw-tooth leading edge. Carrying two 1,000 lb. bombs and two 100-gallon drop tanks. Hunter Trainer first flew July 8, 1955; production T.7 flew October 11, 1957.

**Hunter T.8.**—Hawker Aircraft, Ltd. One Rolls-Royce Avon 100-series. WW664. Standard production Hunter Trainer for the R.N., similar to the Hunter T.7 with arrester hook for training approaches at land airfields (not intended for carrier use). Has four 100-gal. tanks. First flew March 3, 1958.

**Javelin FAW.7.**—Gloster Aircraft Co., Ltd. G.A.5. Two 11,000 lb.s.t. Armstrong Siddeley Sapphire 200-series (A.S.Sa.7) turbojets. XH901. Production-type Javelin in static park, carrying two 250-gallon tanks under fuselage, two Firestreaks and two Microcell 37 x 2-in. rocket packs. Also shown, four 100-gallon drop tanks and four 1,000 lb. bombs, as alternative loads. Javelin first flew November 26, 1951; Mk. 7 flew September 30, 1955.

**Javelin FAW.8.**—Gloster Aircraft Co., Ltd. G.A.5. Two 12,300 lb.s.t. Armstrong Siddeley Sapphire 200-series (A.S.Sa.7) turbojets with afterburners. XH966. First production Mk. 8 with different A.I. radar and re-heat engines, carrying four D.H. Firestreaks. Only one 30 mm. cannon in each wing when Firestreaks carried. First Mk. 8 flew May 9, 1958.

**Jet Provost T. Mk. 3.**—Hunting Aircraft. Ltd. P.84. One 2,460 lb.s.t. Armstrong Siddeley Viper A.S.V.11 turbojet. G-AOUS. Development Mk. 2 aircraft now fitted with uprated Viper engine, giving 40% more power than standard. Also XM348 in static park, third production T. Mk.3 for R.A.F. Training Command with 1,750 lb.s.t. Viper 102 (A.S.V.8) and representative underwing stores. Jet Provost first flew June 26, 1954; T. Mk. 3 flew June 22, 1958.

**Lightning F.1.**—English Electric Co., Ltd. Type P.1B. Two Rolls-Royce Avon 200-series turbojets with afterburners. XA847 and XG308. Prototype and pre-production P.1B, both shown carrying two de Havilland Firestreaks and with 30% more fin area. First P.1A flew Aug. 4, 1954; P.1B, April 4, 1957.

**Pembroke C.54.**—Hunting Aircraft, Ltd. P.66. Two 540 h.p. Alvis Leonides 127 engines. SC-304. Standard production model for German Kriegsmarine, equipped as radio and navigation trainer, with transparent nose. First flew November 11, 1952.

**President 2.**—Hunting Aircraft. Ltd. P.66. Two 540 h.p. Alvis Leonides 514 engines. G-APMO. Production President with uprated Leonides engines, as built for the M.T.C.A for calibration and checking of airborne telecommunications. Also G-AOJG, original demonstrator equipped as six-passenger executive transport. First flew August 26, 1956.

**Rotodyne.**—The Fairey Aviation Co., Ltd. Two 3,000 e.h.p. Napier Eland N.El.3 turboprops. XE521. First prototype of the Fairey convertiplane. First flew October 25, 1957; first full transition, April, 1958.

**Saro P.531.**—Saunders-Roe, Ltd. One 300 h.p. Blackburn-Turboméca Turmo shaft turbine. G-APNU, first prototype of Saro's new P.V. general-purpose helicopter. Also G-APNV, second prototype, with air-driven winch, in static park. First flew July 20, 1958.

**Scorpion-Canberra.**—D. Napier and Son, Ltd. One Napier Double Scorpion N.Sc.D.1 rocket engine and two Rolls-Royce Avon 101 turbojets. WK163. Standard Canberra 2 modified by Napier for rocket engine flight trials. First flew with Scorpion in 1956.

**Sea Vixen FAW.1.**—de Havilland Aircraft Co., Ltd. (Christchurch). D.H.110. Two Rolls-Royce Avon 200-series turbojets. XJ475. Production aircraft as shown last year, carrying four Firestreaks under the wings and two 150-gal. tanks. Mock-up installation for 28 x 2-in. air-to-air rockets in each of two retractable Microcell racks alongside the nose-wheel well. Alternative stores also shown include 37 x 3-in. rocket underwing pods, ground-attack R.P. Mk. 5s,

(*Continued on page* 393)

A Microcell 37 x 2-in. rocket pod (with nose cap removed), and a Firestreak air-to-air missile under the port wing of a Javelin FAW.7.

# Flying the Miles Student

## by John Fricker

IT is now generally accepted that all-through jet training is essential for military pilots, but the procurement of suitable new aircraft for this task is an expensive business, particularly for the smaller air forces.

In designing the Student, Miles Aircraft set out to produce, for *ab initio* and basic flying tuition, a jet trainer with the minimum initial cost and economical operating expenses. At the same time, it was made readily adaptable for armament training, with a consequent additional application for light ground-attack duties, while by removal of some of the equipment in the rear of the cabin, the Student can be converted into a four-seat communications aircraft in a few minutes.

Since it first flew, on May 14, 1957, at Shoreham, the prototype Student, which has been produced purely as a private venture, has accumulated well over 100 hr. in the air, mostly in the hands of Duncan MacIntosh, Miles' chief test pilot. During that time it has completed a demonstration tour, through Scandinavia to Finland, in addition to a comprehensive flight test programme, and this week it is being demonstrated at Blackbushe for visitors to the S.B.A.C. Show.

In a private preview of the Student last week at Blackbushe, I was fortunate enough to be checked out by Duncan MacIntosh for my second jet solo, which says a great deal for Miles' confidence in their aeroplane. Curiously enough my only previous solo jet experience had been in another Miles aeroplane—the delightful little Sparrowjet—but I had, of course, completed a fair number of dual handling trips on types ranging from the Fouga Magister to the Hunter T.7 and F-100F Super Sabre. Although having done relatively little flying in recent months, I found the Student easy and very pleasant to fly, but it seemed to me to be entirely representative of more advanced types and not just a jet-powered light aeroplane.

Apart from the extraordinarily compact dimensions and unique configuration of the Student, which wore the new R.A.F. fluorescent red trainer bands in addition to its civil registration (it has a restricted C. of A. for non-commercial flights), its most striking feature is the NACA flush intake for the 880-lb. Marboré IIA above the cabin. Despite pessimistic forecasts in some quarters, this form of intake has proved entirely adequate in all conditions of flight, after fences had been added on each side to prevent overspill at all airspeeds.

A one-piece cowling can be rapidly removed to expose the entire powerplant for inspection, and it is at just the right height for convenient access. The short fuselage-stowed undercarriage leaves the small, gently swept wing completely clean, although on this occasion, the optional tip tanks were installed (but not filled). Only the forward halves of the tip tanks are used for carrying fuel, with a capacity of 20 gal. each, the remainder accommodating the aileron mass balances and providing a suitable fairing. The tip tanks are connected with the four inner wing tanks, which have a total capacity of 100 gallons.

As the Student sits so close to the ground, the cabin is entered as easily as a car, and the resemblance extends to the large automobile-type doors. These are jettisonable for emergency exit and their provision virtually eliminates the need for ejection seats. In any case these would not be in keeping with the minimum weight, complication and economy factors of the Student.

For the same reasons, the cockpit is not furnished with R.A.F.-type equipment, although in size and comfort it is undoubtedly much better than any comparable Service aeroplane. The dual bowed control columns and rudder bars are adapted from standard Messenger/Gemini components, toe brake pedals having been added to the latter, and the interior finish, with smooth plastic, quilted soundproofing and carpets, establishes an unusually luxurious tone for a jet trainer.

A single set of flight instruments is located in the centre of the panel, with French engine instruments to port, and VHF and electrical controls to starboard. The engine, flap and undercarriage controls are mounted on a centre console formed by the fuselage keel, but because of the cockpit doors, duplicated controls for the left-hand occupant are restricted to a simple throttle, Teleflex-linked with the central lever. This means that, at the moment, a certain amount of hand-changing is necessary for undercarriage retraction, etc., rather as in the early Spitfires, unless the central throttle is used throughout.

Back-type parachutes, with attached cushions, complete one's comfort in the Student, and once strapped in, the impression of sitting in a large armchair with an excellent all-round view of the World is confirmed. Large roof windows on each side of the intake duct allow upward visibility, and only to the extreme rear is there a restriction of view.

A touch on the dashboard knob releases the rudder pedals for adjustment of reach, and after a check on the slightly inaccessible parking-brake lever, to the right of the centre console, the Student is ready for starting. At Blackbushe, we were starting on the internal batteries, and under the guidance of Duncan MacIntosh I woke the fast-revving Marboré into wailing life without difficulty.

For taxi-ing a lever on the console selects nosewheel steering or castoring, which is a very civilized system, and with the throttle set at the flight idling gate, giving about 11,500 r.p.m. on the ground, the Student can be driven briskly along "hands-off." Despite the apparently narrow track of the main wheels, ground stability was very good at Blackbushe in winds of more than 20 knots, although a slight and innocuous rolling is said to be noticeable with full tip tanks. The nosewheel steers for up to 22° each side of centre via the rudder-bar and for tighter turns a touch of brake and some power, with castoring selection if necessary, gives adequate manœuvrability.

Personally I mourn the passing of the time-honoured differential hand-braking system, possibly because I am still unfamiliar with toe brakes, but the Goodyear disc brakes on the Student are certainly powerful and effective. Nosewheel steering, which is gentle in operation, is retained for take-off and landing, so that vital actions revolve mainly round the selection of neutral trim, checking air-brakes in, and selecting take-off flap on the two-position quadrant.

Elevator trim is by means of tabs controlled from an electric

*Photographs copyright "The Aeroplane"*

**Despite the small size of the Student, its cockpit is extremely roomy and comfortable. At the moment, all the engine, trim, flap and undercarriage controls are grouped on the centre console, and only the throttle lever is duplicated for the left-hand occupant.**

actuator on the centre console, with an adjacent indicator. The tabs replace the former anti-servo surfaces; their operation is extremely sensitive and quite powerful. Dual, with full internal fuel, we were flying at about 3,500 lb. gross, with the C.G. about 24% aft of datum, while solo I started off some 200 lb. lighter, and with the C.G. around 30% aft.

With full throttle against the brakes to check the maximum r.p.m. of 22,600 and j.p.t. of 625° C., the Student begins to creep forward, and releasing pressure on the toe pedals results in a brisk acceleration. Very little effort is necessary to keep straight during the short ground run, but I found slight difficulty in determining the precise point to pull the Student off the ground. At first I left it rather late, when the speed had reached about 80 m.p.h. or more, and a fairly determined pull was needed, but if the nosewheel is gently raised at 65-70 m.p.h. the aircraft flies itself off at about 80-85 m.p.h.

On changing hands for undercarriage retraction I found that the Student rocked a good deal laterally in the turbulent air, aided by my over-controlling, and for a moment it seemed almost as if powered ailerons had been fitted. Later experience confirmed much of this initial impression, and in their present form the ailerons are very crisp and responsive, with moderate "break-out" stick forces, giving, with the neutral lateral stability, an effect not at all unlike the powered controls of more advanced jet aircraft.

Except for the hydraulic brakes the Student is an "all-pneumatic" aeroplane, with low-pressure (45-lb.) air supplied direct from the compressor of the Marboré through a blow-off valve, and a Kidde emergency air bottle for two complete cycles of flaps, undercarriage and air brakes. A characteristic of this pneumatic system is a noticeable time lag between selection of the required service and its operation. In the case of the undercarriage, its methodical retraction or extension is accompanied by a certain amount of aircraft yawing as the legs come up asymmetrically, but there are no accompanying longitudinal trim changes.

Raising take-off flap before the initial climb, which exceeds 1,600 ft./min. at 155 m.p.h. I.A.S., results in a slight sink and a moderate nose-down change of trim. As the Student's optimum operating altitude is probably about 20,000 ft., which it can reach in about 17 min., it is not pressurized, but oxygen is provided for both pilots.

In the air our first job was to formate, in perfect weather, on the photographic Gemini, and the good low-speed control of the Student at 110-120 m.p.h. quickly became evident. Control loads have been varied according to the individual requirements of prospective customers, but at the moment, the elevators of the Student appear rather heavier than the ailerons, with the rudders fairly light and effective but seldom used. Stability is normal, and the general handling viceless.

In a clean stall at about 5,000 ft., which because of the substantial residual thrust from the flight-idling setting of the Marboré, takes place in a slight climb, mild buffeting started at about 95 m.p.h. I.A.S. and continued unchanged with rapidly decreasing aileron control until a sharp breakaway at 80-85 m.p.h. The starboard wing dropped smartly, but forward movement of the stick restored instant control, and the loss of height was not great. With flaps and undercarriage extended, the warning is apparently less, and once again, either wing may drop at 70-75 m.p.h. I.A.S.

Apart from one-turn spins, which are entirely conventional for entry and recovery, spinning trials have not yet been conducted with the Student, but are due after the S.B.A.C. Show and when a spin-recovery parachute has been fitted. There is apparently no tendency towards incipient spins during stalls. Relighting trials with the Marboré are also scheduled in the near future, but no problems are anticipated there. Although no automatic fuel control is fitted, engine-handling qualities in the Student are good, and the Marboré may be opened from flight idle to full throttle in 6-7 sec. Normal care is needed on the ground at the low engine r.p.m. to avoid resonance.

Aerobatics, except when full tip tanks are carried (when they are prohibited), are a delight in the Student, which rolls briskly round at about 120°/sec. between 160-180 m.p.h. The maximum continuous power setting of 21,000 r.p.m. gives ample thrust for most manœuvres, and will quickly accelerate the Student in level flight to 220 m.p.h. for a loop. This can be done at about 3$g$ with little effort, although I found slight difficulty in keeping the wings level at the top through being seated off the centre line. I found no tendency to buffet, however, within the $g$ loadings encountered, and with an elevator force of about 10 lb. per $g$, the Student is not likely to exceed its operating design limitations of +6.7 and $-2\frac{1}{2}g$.

At higher speeds there is a progressive and logical all-round increase in control forces, with no adverse or noticeable Mach characteristics. Duncan MacIntosh has had the Student up to 390 m.p.h. T.A.S. in a 45° dive from 10,000 ft., and the design diving speed is 460 m.p.h. The air brakes, which are small perforated wedges extending from the fuselage, operated from a lever on the console, have been opened up to 360 m.p.h., with a fairly pronounced nose-up trim change and moderate buffeting. With the throttle at flight idling, the air brakes give a comfortable descent of about 2,000 ft./min. at 200 m.p.h. I.A.S., accompanied by a milder trim change and buffet.

With their assistance, or by throttling back, speed can be reduced to about 140 m.p.h. in the circuit for undercarriage extension, followed by the lowering of 20° of flap. A little nose-down trim and about 19,000 r.p.m. are then needed to maintain about 120 m.p.h., which is progressively reduced on finals to 100 m.p.h. when the full 45° of flap is selected. Over the boundary, 85-90 m.p.h. gives a slightly nose-up attitude as power is taken off, and very little further aft stick movement is needed for a smooth touch-down, cushioned by Dowty Liquid Springs, on the main wheels.

The nosewheel can be kept off the runway for some time for aerodynamic braking, while the throttle is brought back through the gate into ground idling, and then the brakes can be applied quite firmly as required. As the wind was blowing strongly 90° across the main runway at Blackbushe, we operated from the short strip at right angles to it, but I found it possible to pull up before reaching the intersection, despite my limited experience on the type.

A baulked landing approach in the busy pattern proved quite straightforward, except for my failure to reduce the speed sufficiently after selecting undercarriage up, which resulted in the fuselage doors remaining open until I had pulled the nose up to about 110 m.p.h. I.A.S. The change of trim was moderate, and could easily be held with one hand.

When flying solo, I found that for economical cruising about 18,000 r.p.m. gave a speed of nearly 200 m.p.h., which at sea level results in a fuel consumption of some 65 g.p.h. At max. continuous power of 21,000 r.p.m. the cruising speed becomes 255-260 m.p.h. for a consumption of 105-60 g.p.h. between sea level and 20,000 ft.

The comfort of the Student makes for the optimum confidence, and flying in shirt sleeves with the side d.v. panels giving draught-free ventilation, and my left arm resting on the padded door sill, I could have played indefinitely with this delightful and willing toy. Unfortunately, the tiny and uncalibrated fuel gauges stayed obstinately at "full" throughout my trips, and so after a sortie time of more than an hour, including four circuits and landings with plenty of taxi-ing, I reluctantly decided to play safe and call it a day.

A long finals with a fair amount of power, and a little excess speed to give a brief float, and then the mainwheels settled smoothly, if slightly unevenly, to conclude a most satisfying experience. On refuelling we discovered that 30 of the 94 usable gallons of kerosene remained in the tanks, so that in fact I had a ½-hr. margin, which confirms the Student's economy.

At a provisional price of about £17,000 the M.100 is less than half the cost of any comparable jet trainer, and in one of its alternative design layouts with engines of up to 1,500-lb. thrust, would obviously also represent extraordinarily good value as a high-speed executive transport.

**Leading Particulars**

DIMENSIONS.—Span, 29 ft. 2 in.; length, 31 ft. 6 in.; height, 6 ft. 3 in.; gross wing area, 144 sq. ft.

WEIGHTS.—Tare (equipped), 2,400 lb.; gross, 3,600 lb.; overload (tip tanks), 3,900 lb.

PERFORMANCE.—(At 3,500 lb. weight), max. speed, at 20,000 ft., 298 m.p.h.; cruising speed, at 20,000 ft., 262 m.p.h.; initial climb, 1,780 ft./min.; to 10,000 ft., 6.8 min.; stalling speed (T.A.S.), 68 m.p.h.; still-air range, internal fuel, 444 miles; with tip tanks (total 140 gal.), 621 miles; max. endurance (internal fuel), 2 hr. 15 min.; take-off distance, to 50 ft., 740 yd.; landing distance, from 50 ft., 640 yd.

The diminutive size of the Student is well illustrated by comparison with a Viking at Blackbushe, as the author taxies in after his flight.

*Photograph copyright "The Aeroplane"*

# *Air Transport*

## Comet News

THE order for two Comet 4s from the East African Airways Corporation (see last week's issue, p. 284) was confirmed by de Havilland on August 28.

These Comets, which will be similar to those for B.O.A.C., will be used on the Nairobi-London service—flown in pool with B.O.A.C.'s Johannesburg-London services—and on the Nairobi-Bombay run which E.A.A.C. is at present operating with ex-B.O.A.C. DC-4M Argonauts. The Comets are to be delivered before mid-1960, by which time B.O.A.C. will be flying Comet 4s on the South Africa run.

This month the production Comet 4 will be flying the 100 hours of route proving necessary for its C. of A. It was due to leave next week for Hong Kong, where it will arrive in time for the opening of the new runway at Kai Tak Airport, and, later, to fly to Vancouver. A Comet 4 may also fly to New Delhi in October during the period of the IATA annual general meeting.

B.O.A.C. should have four Comets by the end of the year and 130 crews are being trained, including 260 captains. The Corporation plans an eventual utilization figure of 3,850 hr. per annum.

## The 707 in Experimental Service

THE first commercial landing of a turbojet aircraft in the United States took place, writes a correspondent, at Idlewild Airport on August 24 when a Boeing 707-120 of Pan American Airways touched down after a flight from Puerto Rico. The aircraft had taken off the previous day from Miami, carrying commercial cargo for Puerto Rico, on the first American in-service flight of a turbojet civil transport aeroplane.

This was one of several shakedown flights scheduled by P.A.A. for the obtaining of full C.A.B. certification. The Boeing 707 was delivered to P.A.A. three weeks ago.

P.A.A. hope to introduce their first scheduled transatlantic passenger service by 707 on or about November 1 from New York to Paris. The first domestic turbojet flight by a scheduled airline in the U.S.A. will be over American Airlines' New York-Los Angeles route about January 1 next.

## Two C.A.A. Certificates

FOLLOWING quickly upon the provisional certificates granted by C.A.A. to the Boeing 707-120 came news last week that both the Lockheed Electra and the Eland-engined Convair 340 have received their full airworthiness certificates.

The Electra certification programme has been one of the most intensive yet undertaken, involving four aircraft which made 655 flights. The certificate has been obtained some five weeks ahead of the original target date of September 30, and is the last important milestone in Eastern Air Lines' plan to start Electra service later this month. Concluding item in the C.A.A. test programme was the series of function and reliability tests, calling for 150 hours' endurance flying; this was completed between July 31 and August 15.

For initial operations, the Electra has been certificated at 113,000 lb. gross weight, when the balanced field length is 4,730 ft.—21% better than guarantee. The landing distance is 14% better than guarantee. An eventual increase in gross weight to 116,000 lb. has been shown possible by tests already completed.

The certificate for the Eland-Convair covers modification of the original Convair airframe to have Napier Eland turboprops and follows trials made in the U.S.A. by Napier and PacAero at Santa Monica. These trials included a 100-hour function and reliability test completed in 10 days.

A comprehensive sales tour of North and South America is now to be undertaken, while PacAero complete the conversion of a Convair 440 to have Elands and then start work on the conversions for REAL Aerovias of Brazil.

## M.T.C.A. and the Turbojets

LAST week's statement by the Minister of Transport and Civil Aviation on the matter of turbojet noise levels served to clarify a situation which had been somewhat clouded by tendentious comments—and which was also about to be overtaken by events. It will be appropriate to quote some of the passages from Mr. Watkinson's statement in so far as these indicate and re-state the Ministry's policy.

After pointing out that the problem of noise is of "first importance" among those posed by the new civil turbojet aircraft, the Minister went on to say:—

"The problem of aircraft noise abatement, especially for the new large jet aircraft, has been for some time under intensive study by the major airport authorities in consultation with one another. Much progress has been made, the technique of noise measurement has been standardized and noise suppressors have been designed which can substantially reduce the noise of some of the large jets at source. Tests carried out for the United Kingdom authorities have shown that suppression in the case of the Caravelle and Comet will reduce the impact of their noise so that it is comparable with that of piston-engined aircraft already in commercial use.

"Meanwhile the further abatement of noise from jet aircraft will depend to a great extent on techniques of operation and therefore on practical experience of the aircraft at our airports. This means an initial period of experiment. During this period those jet aircraft which have yet to be proved as adequately silenced at source will only be permitted to operate into United Kingdom airports under conditions designed to reduce disturbance to a reasonable minimum.

"These conditions will include take-off and landing during waking hours only; the use of operating (especially take-off) techniques to reduce noise disturbance to a minimum; and the prescription of noise-reducing measures for ground running of engines. The detailed application of these conditions, in

RUNWAY IN THE SEA.—This recent picture of the new runway at Hong Kong's Kai Tak Airport shows how it is lined up with the bad-weather approach through the south-east gap between Hong Kong Island and the mainland. The runway is already in use and is due to be opened officially on September 12, when the first production Comet 4 is expected to be among the aircraft present at the ceremony.

SECOND EIGHT. — Douglas rolled out the second DC-8 from their Long Beach factory last month. Finished in United Air Lines' colours and named "DC-8 Jet Mainliner Long Beach," it will join the first DC-8 (flown on May 30) on certification trials which are scheduled to allow United to introduce the DC-8 in domestic service by next autumn.

particular those affecting the main operating techniques, will vary according to aircraft types and must be worked out specifically for each case. It may be that in some cases the economic capacity of the aircraft will be affected. During this period both the general and specific restrictions will be provisional and will be reviewed and modified as necessary in the light of experience."

The statement then goes on to say that, in addition to those to be operated by the Caravelle and Comet, services into U.K. airports have been planned for both the Boeing 707 (initially on Pan American Airways' Atlantic Services) and Aeroflot's Tu-104.

"As regards the Tu-104," the statement continued, "the Government have been in consultation for some time with the Soviet authorities in order to solve noise problems so that a London/Moscow service may be operated in parallel by Aeroflot and B.E.A. The Soviet authorities have now informed the United Kingdom authorities that they have developed techniques of operation which will reduce the noise of the Tu-104 to that of existing piston-engined types. The Government welcome this constructive development which accords with the general policy the Minister has evolved. In reply, therefore, the Soviet Government have been informed of this policy and the general conditions under which the Minister would be able to admit the Tu-104 and similar large jets, and they have been asked for fuller details of the Soviet operating techniques in order that precise conditions governing Tu-104 services into London Airport may be agreed and so that an early date for inaugurating the Moscow/London services can be fixed. . . ."

Meanwhile Pan American has approached the M.T.C.A., following the Minister's recent visit to the Port of New York Authority, for permission to bring a Boeing 707-120 into London Airport during this month (probably about September 7) for a period of experiment with operational procedures and noise tests. This operator has proposed certain restrictions and has asked permission to follow the trials with a number of crew-training flights under the same conditions—or modified as the earlier trials may show to be necessary.

The restrictions proposed by Pan American are as follows: (a) operation during waking hours only; (b) good weather operations only; (c) no operations with the aircraft exceeding 190,000 lb. gross weight; and (d) the aircraft at all times to be operated in such a way as to minimize the effect of noise.

# B.E.A. Fares and Equipment Plans

IN the first six months of 1958, B.E.A. passenger traffic increased by 5% compared with the same period in 1957. In previous years, the increase has been of the order of 15-20%. This is a measure of the problem confronting B.E.A. today, in common with most of the World's other airlines, and the hard fact of this decline in rate-growth provides a sobering background against which B.E.A.'s record profit for the year 1957-58 must be reviewed.

Details of the profit—£1,054,807 after deducting interest—were given in the Corporation's annual report and account, the principal points from which were outlined in THE AEROPLANE last week (pp. 289-290). The report itself was published after that issue went to press and additional information was given at the Press conference which accompanied its publication. At the conference, Lord Douglas said: "We shall have a tussle to end in the black this year"; but the general opinion at B.E.A. is that the set-back is only a temporary one and that the growth of air traffic will continue at a general rate of probably 10-12% after the present business recession has passed.

B.E.A. had in fact budgeted for a 10% increase in traffic this year, so some falling-off in load-factors seems inevitable. In present circumstances the Corporation can be thankful that its fleet capacity will not be increased until the Comet 4Bs go into service in the summer of 1960, together with the first of the Vanguards.

Three ways in which the World airlines can improve their financial situation in the difficult years ahead are suggested in the B.E.A. report and have been amplified by Lord Douglas. They concern fare structures and re-equipment plans.

In the first place, B.E.A. support a policy of fare reductions to stimulate new classes of traffic. Although it is felt that little can be done in the present year, apart perhaps from special cheaper fares on selected routes, B.E.A. hope next year to initiate a policy of fare reductions in Europe through the I.A.T.A. Traffic Conferences. Just how big a reduction may be possible remains to be seen, but the Corporation is confident it will have the support of other operators in this policy. It is in marked contrast to the present demand by the U.S. domestic operators for a fare increase, but no direct parallel can be drawn between the U.S.A. and Europe, particularly as the basic American mileage-rate is very much lower than that in Europe. Today, B.E.A. international fares, at 6d. per passenger mile, are the same in actual value as they were in 1948; in 1948 money values, they are about 40% cheaper.

The second B.E.A. proposal, concerning fare differentials, is very much more contentious. After lengthy deliberation, the Corporation has decided to support the principle of a fare differential for turbojet aircraft, and will maintain this position at the I.A.T.A. Traffic Conference at Cannes next month. In general terms, B.E.A. will advance the view that jet fares should be some 10% higher than the prevailing basic rates, at any given time, which would apply to piston or turboprop equipment.

The arguments to be advanced in support of this view will be based not so much on operating costs of the two types of aircraft—although the Corporation still adheres to the conclusions of Lord Douglas's 1957 Brancker Memorial lecture. Rather, the thought is that the greater speed of the jet will make it more attractive to the travelling public, which will therefore be prepared to pay more. A fare differential, at least in the initial period of jet operations, will help to keep in service existing aircraft types which have not been fully depreciated and "to avoid an unnecessarily fast and expensive re-equipment programme which must ultimately result in a higher general level of fares than need be the case."

There is certain to be strong objection to this policy within

the traffic Conferences and B.E.A. is not very hopeful that its view will prevail. A recent "sampling" of the 10 members of the Air Research Bureau showed a more-or-less equal division of opinion on the subject.

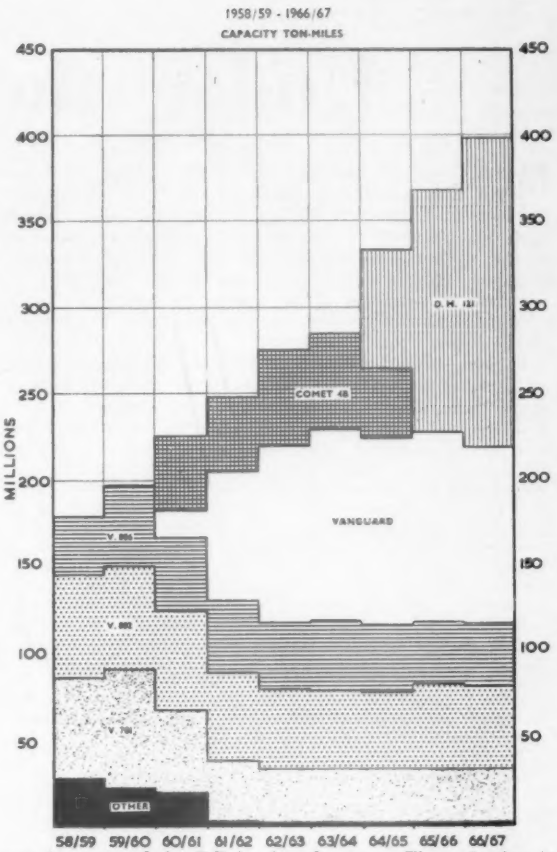
Operators with a preponderance of jet equipment in their future fleets will certainly object, but an even bigger objection, to which even the proponents of differentials have no effective reply, is the complexity of the fares structure which would result. Since it would scarcely be possible to set aside all jet aircraft as exclusively first class, there would be basic tourist and first-class fares, both with jet surcharges, in addition to the specially reduced night tourist, excursion and other rates. It must be recognized, however, that the rejection of a differential fares policy will mean that any reduction in the basic European fares structure will be less than might otherwise be the case and the travelling public will, in the long run, be paying the price of the over-rapid jet re-equipment programmes upon which the World airlines have embarked.

This point is the third made by Lord Douglas. "We believe," says the report, "that the whole air transport industry will continue to face the problem of inadequate profit margins until it recognizes that its rate of re-equipment should be slowed down. We are urging the international airlines in I.A.T.A. to give serious thought to this problem. If, with the new generation of aircraft which the airlines of the World have on order, it were possible to extend commercial lives and thus depreciation periods substantially beyond the seven years which is now general practice, the future financial prospects of the whole airline industry would be improved."

With the exception of the Comet 4Bs, this policy is already being implemented by B.E.A. with their current aircraft types. The fleet of 25 Viscount 701s, for instance, is expected to be still in service in 1967, 14 years after the first was delivered and 12 years after the fleet was completed. The Viscount 802 and 806, Vanguard and D.H.121 fleets will similarly be kept in service for long periods.

Of the other types operated by B.E.A., the six Comet 4Bs will be amortized over about five years and then returned to de Havilland. The DC-3 fleet of 45 aircraft will continue at full strength until 1960, and will then be reduced to four or five aircraft required "indefinitely" for services to three Scottish aerodromes which cannot accept the Viscount. The three D.H.89 Rapides are similarly required for the Scilly Isles service and two Herons for the Scottish ambulance service.

A chart on this page shows the relative productive capacity,




year by year, of the B.E.A. aircraft types. The reduction in productivity of the V.701s is accounted for by their relegation to domestic services by 1961, when annual utilization will drop from about 2,400 hrs. to 1,600 hrs. By the end of 1967, the 24 D.H.121s are expected to be producing some 45% of the total B.E.A. capacity.—F.G.S.

## *Points From the Report . . . .*

- *A Viscount 701 is being modified to a 60-63-seat high-density arrangement as a trial installation, planned for use on domestic routes in 1960.*
- *B.E.A.'s Viscount 806s are to be modified for operation at 64,500 lb. instead of 63,000 lb.*
- *Five per cent. of B.E.A.'s total revenue—over three million dollars—comes from North America. Agents there work on a "sell and tell" basis, making reservations as necessary and informing B.E.A. afterwards.*
- *At March 31, 1958, B.E.A. had 119 fixed-wing aircraft in service, an increase during the year of 12.*
- *During the year 1957/58 B.E.A. recruited 102 pilots, the great majority from the R.A.F.*
- *Simulator flying hours during the year were: V.701, 2,026 hrs.; V.802 (half-year only), 1,064 hrs.; and Pionair/Elizabethan (half-year only), 636 hrs.*
- *Maintenance man-hours expended per flying hour in the first twelve months of service of three aircraft types were: Elizabethan, 8.80; V.701, 5.58; and V.802, 3.23—showing the improvement possible when using aircraft developed from earlier types.*
- *The D.H.121 will accommodate about 80 "Standard Class" passengers or approximately 100 in high-density configuration; will carry capacity payload for a stage length of 1,000 miles cruising at about 600 m.p.h.; and will operate from 6,000-ft. runways.*
- *The Scottish Air Ambulance service carried 304 invalids on 232 flights. Over 50,000 miles were flown.*
- *B.E.A. plan in the mid-1960s to use the D.H.121 on longer international routes and the Vanguard on shorter international routes and domestic trunk routes.*

## *. . . . and from the Press Conference*

- *B.E.A. is the World's second largest airline in terms of passengers carried on international routes. B.E.A. has the World's largest Viscount fleet (64). A B.E.A. aircraft takes off or lands once every two minutes day and night throughout the year.*
- *B.E.A. has flown 17½ m. passengers in 10 years—4¼ m. of them in Viscounts.*
- *The six Comet 4Bs will be amortized over five years and then returned to de Havillands.*
- *B.E.A. re-equipment plans are based on continuing 10-12% traffic growth.*
- *B.E.A. expect a demand for higher salaries from jet crews—but fewer crews will be needed.*
- *Comet 4Bs will have a three-pilot crew and no flight engineers.*
- *Possibility of an overhead rail link from West London Air Terminal to London Airport is being considered, among other proposals.*
- *"I am sure there are many piston-engined aircraft on sale in the World today which will never sell." (Mr. A. H. Millward.)*

# Under the Victor's Skin

DETAILS of the Handley Page Victor's construction have just been revealed in an article by Mr. R. H. Sandifer, F.R.Ae.S., assistant chief designer (structures) of Handley Page, Ltd. He gives much information about the unique design of the Victor's wing and tail unit and the type of sandwich structure used, as well as its fatigue and fail-safe properties. The following account of the design and construction of the crescent wing and high-set T-tail is based on Mr. Sandifer's article.

In common with all aircraft structures the Victor airframe was designed as the lightest structure strong enough to withstand all the loads it would carry and stiff enough to prevent flutter and other adverse aeroelastic effects. It was to maintain a smooth aerodynamic form and remain free from surface waviness under normal flight loads. An adequate fatigue life was needed and fail-safe characteristics were desirable. Manufacture and maintenance were to be straightforward and simple.

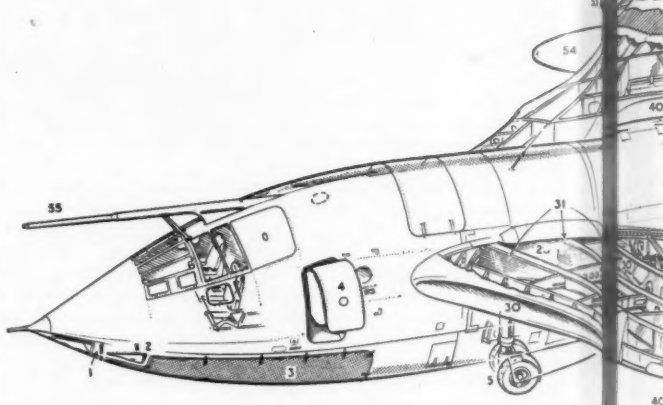
In designing the wing many sets of flight conditions such as symmetric and asymmetric manœuvres and gust loadings were studied. Aeroelastic and dynamic effects were taken into account. At the same time ground loads during landing, manœuvring and taxi-ing were evaluated. Special loads which arose from the carriage of fuel were calculated, and included inertia loads during manœuvres and the pressurization loads necessary to prevent the fuel boiling at altitude. The total internal pressure was as much as 20 p.s.i. All these calculations led to systems of loading on the wing, in the form of bending moments, shear forces and torques, combined with superimposed pressures in the fuel cells.

The wing structure was required to carry these wing loads along the span to the wing root. Studies showed that this was best done by a series of spanwise webs capped by load-carrying skins with reinforced ends which together formed multiple torsion boxes.

Calculations indicated that maximum aerodynamic and structural efficiency would be achieved if the skins possessed inherent bending and shear stiffness in both directions. This would stabilize the skins so that they could carry spanwise compressive loads without needing closely-spaced wing ribs; their stiffness would also provide a chordwise load-path for the effects of fuel pressures and aerodynamic loads. The solution adopted by Handley Page was to use sandwich panels with spanwise cores of corrugated sheet for both top and bottom wing surfaces.

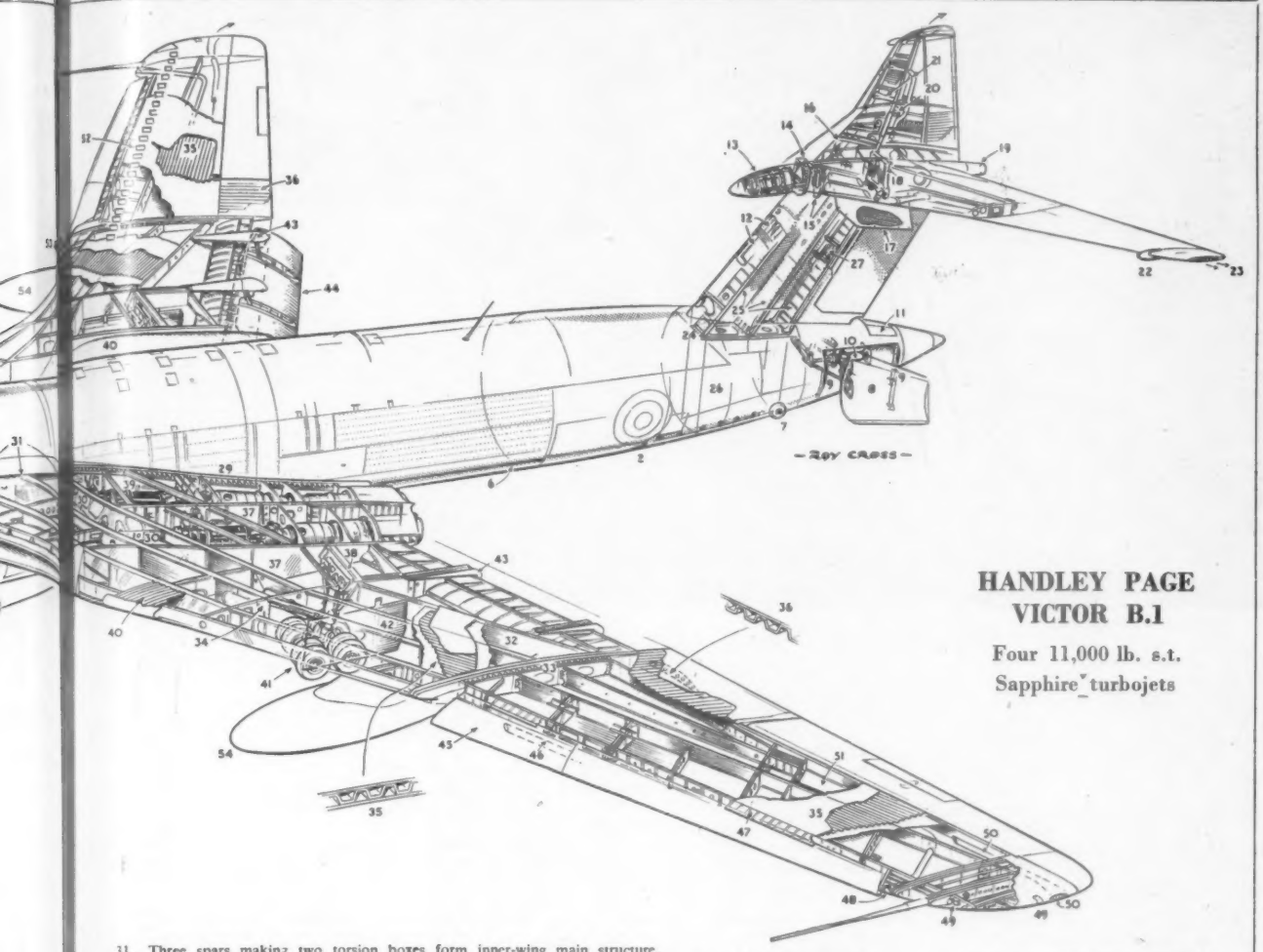
To maintain a smooth outer surface the outer face-plates of these sandwich panels are spot-welded to the corrugated sheet core. This gives an outer surface so smooth that it is often impossible to see the position of a line of spot-welds. The inner skins of the panels are attached to the cores by blind rivets.

On the Victor, sandwich panels are used for rib webs and for intermediate spanwise webs as well as at the wing surfaces. This is done to give the webs lateral-bending stiffness under the action of tank pressures and to provide a smooth internal surface for bag fuel-tanks.




**KEY**

1. Vortex generators
2. Flush intake.
3. Detachable radome.
4. Crew entry door.
5. Rearward-retracting twin nose wheels.
6. Bomb-bay doors.
7. Tail bumper wheel.
8. Air brake extended.
9. Air-brake hinge linkage.
10. Air-brake operating jack.
11. Tail-parachute stowage.
12. Anti-icing passages in leading edge for hot air.
13. Bullet fairing for T tail unit.
14. Slinging point.
15. Fin front-attachment fitting.
16. Elevator power-unit compartment.
17. Hinged access panel to elevator power unit.
18. Forging for fin rear-spar pickup.
19. Light tail-fairing structure.
20. Elevator hinge.
21. Hot-air anti-icing duct.
22. Mass balance.
23. Hot-air outlet (anti-icing).
24. Shear fitting at base of fin front-spar.
25. Fin fore and aft main spars and secondary middle spar form two torsion boxes.
26. Reinforced structure to carry tail loads.
27. Rudder operation skew-lever mounting.
28. Main wing-fuselage joint.
29. Subsidiary wing-fuselage joint.
30. Main air intake divides to feed buried engines separately.




## HANDLEY PAGE VICTOR B.1

**Four 11,000 lb. s.t. Sapphire turbojets**

31. Three spars making two torsion boxes form inner-wing main structure.
32. Outboard of landing gear there are four main spars forming three torsion boxes which extend to the outer wing panel.
33. Inner-to-outer-wing joint.
34. Major rib has corrugated-sandwich web.
35. Spanwise corrugated-sandwich skin on outer wing.
36. Chordwise-corrugated skin reinforcement over wing trailing-edge behind torsion boxes.
37. Fire-resistant engine-bay bulkheads have webs of high-grade commercially pure titanium.
38. Landing-gear support beam.
39. Armstrong Siddeley Sapphire A.S.Sa.7 engines each of 11,000-lb. thrust.
40. Top skin reinforced with chordwise corrugated sheet in vicinity of power units and landing gear, and on parts of leading edge.
41. Eight-wheel main landing-gear bogie.
42. Main landing-gear door.
43. Flap-track housings.
44. Flaps extended.
45. Two-piece leading-edge flap.
46. Hot-air anti-icing in nose flap.
47. Nose-flap shroud.
48. Cooling-air inlet-duct.
49. Wingtip lights.
50. Cooling-air exit-duct.
51. Aileron power-unit compartment.
52. Vortex generators along wing upper surface.
53. Bag fuel tanks within wing structure.
54. Under-wing fuel tank.
55. Air-to-air refuelling probe.

*Drawing copyright "The Aeroplane"*

Over the centre fuselage and about half the inner wing the Victor has three main spar-webs and two torsion boxes. Outboard of the undercarriage there are four main webs and three torsion boxes. These spar-webs have structural kinks at points where the sweepback changes. There are chordwise joints at the fuselage side and between the inner and outer wings.

There are only eight major wing ribs on each side of the fuselage; they interchange bending and torsion moments at the wing kinks and feed concentrated loads into the primary structure. Such loads arise from the engines and undercarriage, which are behind the torsion boxes.

Sandwich panels at the wing surface over the torsion boxes have corrugated cores which run spanwise. Behind the torsion boxes the wing surface is stiffened by a chordwise-corrugated sheet; this has no inner skin attached to it and thus does not form a true sandwich panel. This corrugated sheet runs chordwise to minimize the picking up of spanwise end-loads in the secondary structure.

Special chordwise connections are used at main wing transport joints. These joints are formed by long forgings which butt together and are inserted between the faceplates of the sandwich panels; they extend over the chord length of the wing torsion box. The forgings are attached to the sandwich panels by groups of bolts, countersunk where necessary to give a flush surface; the core is cut back for the entry of the forged joint member and its load is transferred to the forgings by local doubling plates. The forgings are joined by tension bolts which fit in slots in the forgings.

This Victor, the first to carry an air-to-air refuelling probe and under-wing tanks, was photographed during its maiden flight on August 27.

*Photograph copyright "The Aeroplane"*

### Materials

Material choice is a compromise between achieving the minimum structure weight for a given static strength and the provision of adequate safeguards against stress cracking and premature fatigue failure. Because a bomber does not have as long an operational life as a transport aircraft in terms of flying hours, in the Victor's design advantage of high-strength light alloys was taken; at the same time the aircraft was designed for an adequate safe life.

Skins of the primary wing structure are of high-strength aluminium-zinc-copper alloy, to specification DTD 687. Forgings and extrusions are of DTD 683. Secondary structure is of L72 or L73 aluminium-copper alloy.

Titanium has been used where appropriate; engine-bay ribs

*Photograph copyright "The Aeroplane"*

have titanium webs, giving a 250-lb. weight saving, and titanium bolts are used where suitable.

Magnesium-zirconium castings are used for detail parts in the wing, tail, fuselage and controls. This material has a favourable strength-to-weight ratio compared with aluminium alloy and equally good fatigue characteristics.

The inner-wing spar webs are of interest because of the large holes in them necessary for the engine air intakes. Webs of the first and third spars are made from sheet which is machined all over to vary its thickness according to load intensity. Inner edges of the holes are reinforced by one-piece forged rings. On later aircraft a one-piece forged plate is used which incorporates the forged rings. The middle spar web carries a lower load and is of sandwich construction, with forged rings around the holes.

When the Victor was in the early stages of its development, stress cracking was experienced. Every effort has been made to reduce or minimize residual stresses on production aircraft. Special attention is paid to heat treatment of machined parts. To minimize assembly stresses the limits which regulate the fit of mating parts have been closely controlled. Controlled torques have been specified for tightening major bolts.

Early in the Victor's design, fatigue tests were made on the critical chordwise joints at the underside of the wing which were in tension during flight. These tests, which formed a basis for safe-life calculations, confirmed that sandwich panels act in a fail-safe manner.

### Fatigue and Fail-safe Features

First indications of fatigue failure are small cracks in the faceplates of the sandwich panels. Almost invariably these cracks appear initially in the outer faceplates, which are more easily inspected. This happens because the outer plate is spot-welded to the corrugated core and is relatively stiffer than the inner plate, which is riveted to the core. Because of this greater stiffness, and because the outer faceplate is farther from the wing neutral axis, the outer plate takes a slightly greater end-load and fatigue cracks appear in it first.

The corrugated core over the torsion boxes is in two pieces with a spanwise joint between the spars. This acts as a fail-safe feature because it limits the extent of a crack to half the distance between the spars. This is an advantage, as it is very difficult to inspect the core.

The core of corrugated-sandwich panels has never failed on test before failure of the faceplates. But even if the core did fail over half the distance between two webs the bending strength of the Victor's wing would not fall below 90% of the design value. In torsion the residual strength would be even greater than 90%.

Tests show that small cracks in the faceplates occur at 60-80% of the total life of the sandwich panel; they grow slowly at first, giving ample warning of final failure. Because of scatter a generous safety factor is applied so that loading cycles in service are considerably less than those achieved on test. This means that cracks are unlikely to occur in sandwich panels before the permissible safe life of the structure is reached; if they do occur, ample warning is given before a dangerous position is reached. Fatigue tests show that cracks invariably appear first at the joints. Inspection during the later stages of an aircraft's life can be arranged accordingly.

Another fail-safe feature of the Victor's wing is the use of sandwich panels to carry bending end-loads. Bending loads are thus distributed across the chord rather than being concentrated in extruded spar booms. Even near the wing root the spar booms make up only 30% of the total area of material which carries bending loads. This 30% in itself is spread over at least three spars.

Chordwise cracking of panels is limited because there are spanwise joints at each web. Even if one panel or box fails completely there is always one or more alternative load-paths and residual strength is high.

Other fail-safe features are the corrugated sandwich webs of the major ribs, which have three sheets instead of one to act as a path for loads, and the transport joints of the wing, which have double booms; these form a fail-safe structure.

### Tail Unit

The T-tail was chosen so that the tailplane would be well clear of the jet stream. Both aerodynamically and structurally it proved most efficient to place the tailplane on the top of the fin with a bullet-shaped facing at the junction. Detail design of the tail-unit structure is similar to that of the wing; it has the same fail-safe characteristics.

The elevator and tailplane have two main shear webs and four ribs. There are twin elevator ribs at the power-control skew lever, a rib at the outer hinge and a main rib at the tailplane tip. Each elevator is rotated by a skew lever whose main shaft is moved by the power-control jack in a spanwise direction. The transverse axis of the skew lever is at about 45° to the vertical and thus the action of the jack is converted into rotation in a plane at right angles to the jack axis.

The hinge carries most of the elevator load and this load is also the major one applied to the tailplane. Much testing has been done to develop the best structure for both these hinge fittings and their associated ribs.

The tailplane is attached to the fin through a four-point pick-up; the fittings are high-strength light-alloy forgings. Stiffness calculations and checks on a full-scale test structure and in flight were made to determine the true load paths.

The fin has three spars which provide adequate support for the sandwich panels and act as natural stoppers for any chordwise cracks. It is anchored to the fuselage by a distributed chordwise joint similar to the transport joints on the wing. Tailplane loads are taken into the fuselage via fore-and-aft bulkheads which transmit the sandwich-panel shear and bending loads to two transverse bulkheads.

The rudder is operated by a skew lever and has three hinges. Rudder skin panels are stiffened by chordwise-corrugated sheet, but there is no inner faceplate. This is because loads are so light that full sandwich construction could not be used economically with practical skin thicknesses.

# FLYING AT FARNBOROUGH

## *by Wren*

FOR one week in every year some 60 of the World's best test pilots demonstrate daily at the S.B.A.C. Display the capabilities of the immense variety of aircraft types offered by the British aircraft industry.

Their flying is integrated and watched over by the S.B.A.C. Flying Control Committee, consisting of Gp. Capt. D. P. Hanafin, O.C. Experimental Flying Dept., R.A.E. (chairman); Gp. Capt. R. E. Burns, Commandant, Empire Test Pilots' School; Cdr. Ken Hickson, R.N., Cdr. (Flying), R.A.E.; Mr. K. I. Pearson, Snr. Air Traffic Control Officer, R.A.E.; Mr. H. W. Goodinge, Asst. Director, S.B.A.C.; Mr. A. W. Bedford; Mr. John Cunningham; Sqn. Ldr. H. G. Hazelden; Mr. A. J. Pegg; and Gp. Capt. R. G. Slade. Representing the Services' participation this year are Gp. Capt. D. S. Wilson-MacDonald, R.A.F., and Cdr. R. M. Crosley, R.N.

The committee study and apply flying regulations, agree general principles of the Display flying and examine each participating pilot's proposed demonstration in terms of time, practicability and safety. Points which have a bearing are the aircraft's state of development, its *g* limits, what external stores

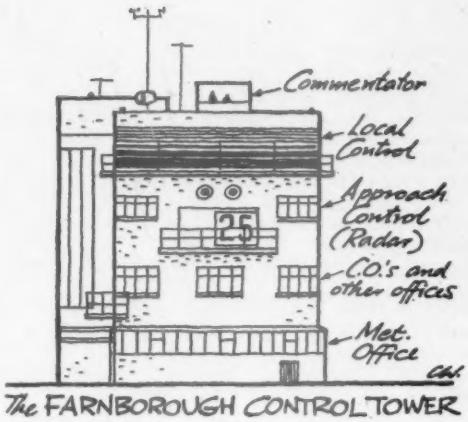
LEN VASS
R.A.E. Control Supervisor

(known to some pilots as "garbage") it may carry, engine power restrictions, if any, and so on. Pilots' plans for their show are examined at the four or five committee meetings held during July and August and a basic flying programme is drawn up. For this purpose good weather is assumed to be possible even in this country, then a stand-by bad weather programme is formulated, when radar-controlled patterns for much-restricted demonstrations would be flown.

Time allocated depends on several factors—technical advance, saleability and novelty being among them. The time allotted to an aircraft may decrease during the several years that it is displayed at Farnborough. Other considerations which bear on its time allowance and position in the programme are "Is it aerobatic?" and "Is it capable of performing with other aircraft?" The aircraft are then grouped:

1. Flying test-beds.
2. Aircraft seen before, not aerobatic.
3. Helicopters.
4. R.A.F. and R.N.
5. Individuals.

Some aircraft, such as the Scorpion-Canberra, are more effectively shown off from a down-wind take-off and have to be fitted in.




The FARNBOROUGH CONTROL TOWER

The emphasis placed on safety is clear from the following extracts from the flying regulations:

Manœuvres likely to jeopardize the safety of the guests or the public in the event of any mishap to the aircraft, or misjudgment, are to be avoided.

Flying over spectators, or towards spectators, within a range of three miles, is prohibited.

No flying must take place below the height of the Control Tower.

As far as possible, and particularly in the case of high-speed runs, demonstrations must be made parallel with, and to the north of, the main runway and spectators' barrier.

Aircraft demonstrations involving cutting and relighting of engines in which there is a possibility of paraffin vapour

THE CRITICS.—Seen at a pre-Display flypast rehearsal. Cdr. Ken Hickson is Cdr. (Flying) at Farnborough and Gp. Capt. D. S. Wilson-MacDonald represents the R.A.F. on the S.B.A.C. Display Flying Control Committee.

streaming from the jet pipe must fly at such a height that no nuisance will be caused to spectators.

Rules imposed by the Ministry of Supply on supersonic flight will apply (i.e.—no bangs).

The "three-mile" or "Derry" rule necessarily circumscribes the shows which the pilots would like to put on—one of them once said: "Not even the Quills and the Humbles could do much with this. . . ." Nevertheless, although they cannot fly quite as freely as they would like, they accept the need for the ruling and demonstrate their aircraft as capably and with as much zest as the earlier pilots.

### A.T.C. at R.A.E.

When the Flying Control Committee have settled the flying programme, they hand it over to the Air Traffic Control at the R.A.E. During the 10 years that the Display has been held at Farnborough, there has developed a close understanding and regard between the pilots and the controllers, whose aim might be summed up as helping without intruding. "Mac" Pearson has been S.A.T.C.O. there for the past five years, and claims to have the only organization working a complete radar system which is entirely British and to have the best control tower set-up in the country.

They have complete radio coverage and the following radar equipment:

Marconi Types 14S High and Low (48,000 ft., 100 miles) and 232 (20,000 ft., 30 miles).

Decca 424 two tubes.

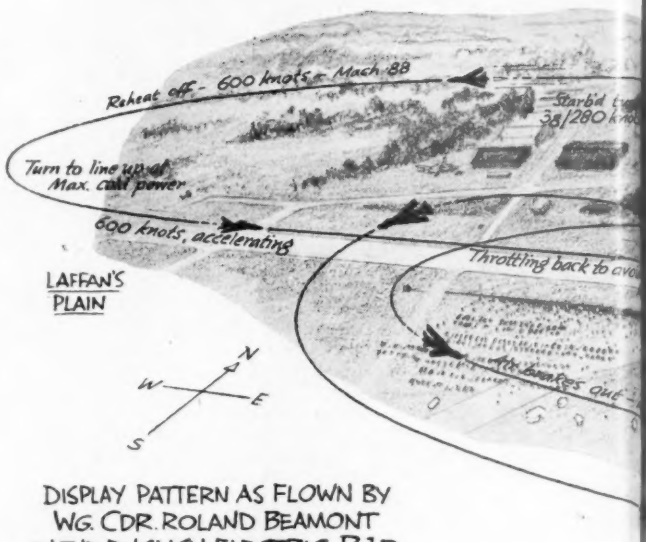
Standard Telephones PV-1B-CREF and Precision Approach Radar.

THE CONTROLLERS.—Gp. Capt. D. P. Hanafin, O.C. Experimental Dept., R.A.E., and K. I. "Mac" Pearson, Senior Air Traffic Control Officer at Farnborough.

Additionally, there is in the tower's radar room the R.A.E. VHF/DF Fixer Network screen on which an aircraft's position can be fixed, in a matter of seconds, anywhere in the southern half of England. This device, "Mac" told me, was indigenous to the R.A.E.—then kindly, for my benefit, he expanded—"Home-made."

A telephone call on a direct line to a fixed station shown as compass faces on a map of the southern half of England will immediately produce on the screen illuminated bearings on the aircraft asking for them. These are correct to within 20 miles, and in association with the radar locate and direct the pilot calling for this information.

In the darkened radar room the operators are well positioned to see each others' screens, so that an aircraft can be passed smoothly from one to another. Then the GCA is operated by one man, cutting out the time lag inherent in the more usual three-man system.




DISPLAY PATTERN AS FLOWN BY WG. CDR. ROLAND BEAMONT IN THE ENGLISH ELECTRIC P.1B LIGHTNING (2 ROLLS-ROYCE AVONS)

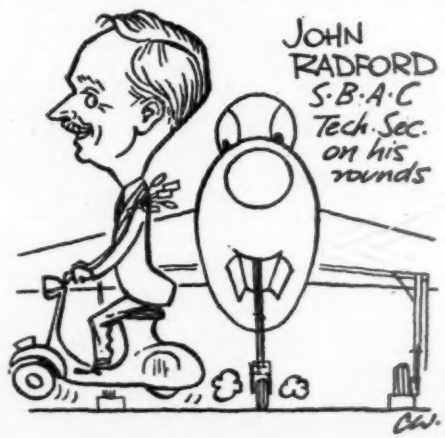
NOTE: This depicts the good weather programme; low cloud or poor visibility can cause marked modification.

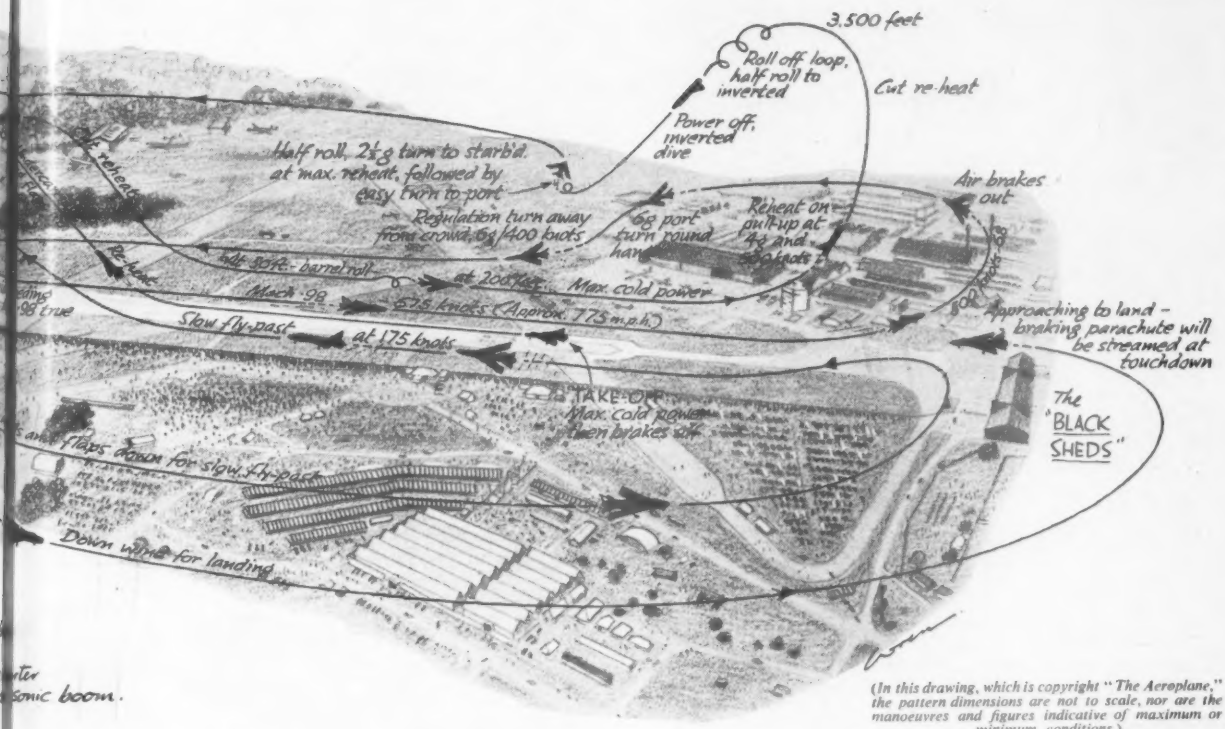
POINT OF INTEREST: During high-speed run, approximately one-quarter of an inch extra movement of the throttle could produce sonic

At least one item of the tower's equipment was selected during a previous S.B.A.C. Display, when "Mac" called in at the "shop" on the other side of the runway. His fine radar array is often examined by visitors from around the World, so the R.A.E. tower might be regarded as a permanent "Farnborough" exhibition of British control-tower equipment.

### In Action

There is little doubt that by the time these words are read, the company of test pilots will have decided that the new O.C. Experimental Dept. is an aviator's aviator. Lively and cheerful, Gp. Capt. "Paddy" Hanafin, C.B.E., D.F.C., A.F.C., has overall charge of the flying during the Display and holds a briefing in the Pilots' Hut at 12.00 hrs. on each day of the Display, when he, "Mac" Pearson and John Brown, Boscombe Down's Snr. Met. Officer, who has come over for the week, hand out instructions, information and advice to the pilots. These briefings are preceded by a meeting of the committee who review the flying of the previous day, and have a word for any pilot who may not have flown *quite* as immaculately as he might have done. After Gp. Capt. Hanafin, responsibility is taken by Cdr. Ken




3,500 feet
Roll off loop, half roll to inverted
Cut re-heat
Power off, inverted dive
Half roll, 2½ g turn to starb'd. at max. reheat, followed by easy turn to port
Regulation turn away from crowd, 6g/400 knots
6g port turn round hammerhead
Reheat on — pull up at 4g and 350 knots
Air brakes out
Half 360°- barrel roll
at 200 kts
Max. cold power
Mach .98
575 knots (Approx. 775 m.p.h.)
Slow fly-past at 175 knots
Approaching to land — braking parachute will be streamed at touchdown
TAKE-OFF
Max. cold power
then brakes off
The "BLACK SHEDS"
Flaps down for slow fly-past
Down wind for landing

*(In this drawing, which is copyright "The Aeroplane," the pattern dimensions are not to scale, nor are the manoeuvres and figures indicative of maximum or minimum conditions.)*

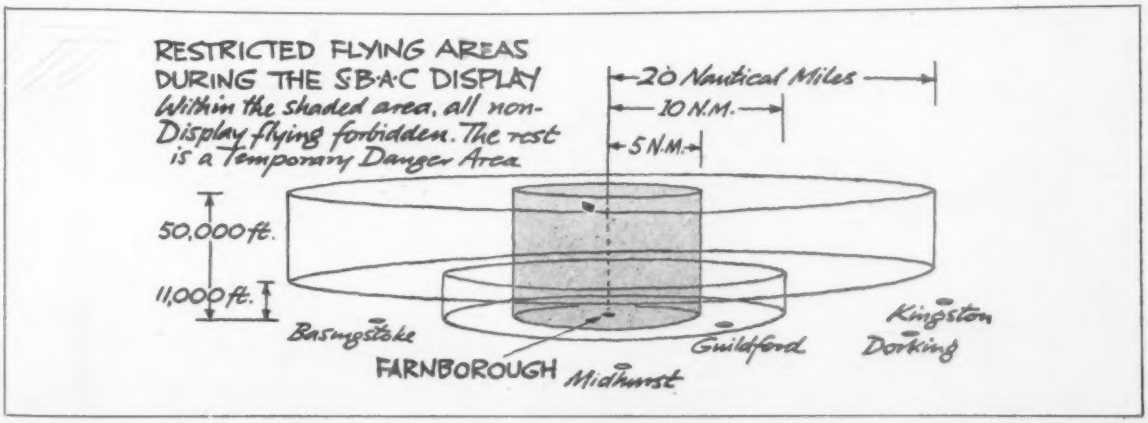
Hickson, A.F.C., R.N., an ex-Instructor of the Empire Test Pilots' School. An example of the sort of decision they might have to make would be to tell a demonstrating pilot, if he was running beyond his time allowance, to divert to Blackbushe or Odiham, the two emergency airfields for the Display.

### The Pilot's Point

By the end of July the Display pilot has a pretty good idea of the answer to the question "What can I do with what I've got?" Being human and, in their way, artists, pilots vary in their approach to the problem. Some like to *ad lib* it, though the majority plan carefully. "Bea" Beamont, English Electric's manager, flight operations, whose display is featured in the accompanying drawing, may be taken as representative of the planners. Knowing the capabilities of the powerful fighter he has to fly, he works out a routine which will include as many of them as are demonstrable and aims to complete them in 20 sec. less than his allotted time, leaving a margin for errors and possible R/T troubles. After practising his show at Warton he likes to put in final rehearsals at Farnborough on the Saturday and Sunday before the Display opens.

The rather abnormal conditions of this kind of flying are evident when you learn that so much *g*—up to 6—is imposed on "Bea" that he dispenses with the "bone-dome" helmet, partly because of the weight it assumes and also because it might obscure his vision. In the incredibly tight turns he pulls with the Lightning he looks not forward but upward to see where he's going. Also, with his head forced down against his chest, the microphone mask might be pushed up over his eyes, so he wears it with the top edge *under* his nose, instead of clasped over it, as would be necessary if he was on oxygen.

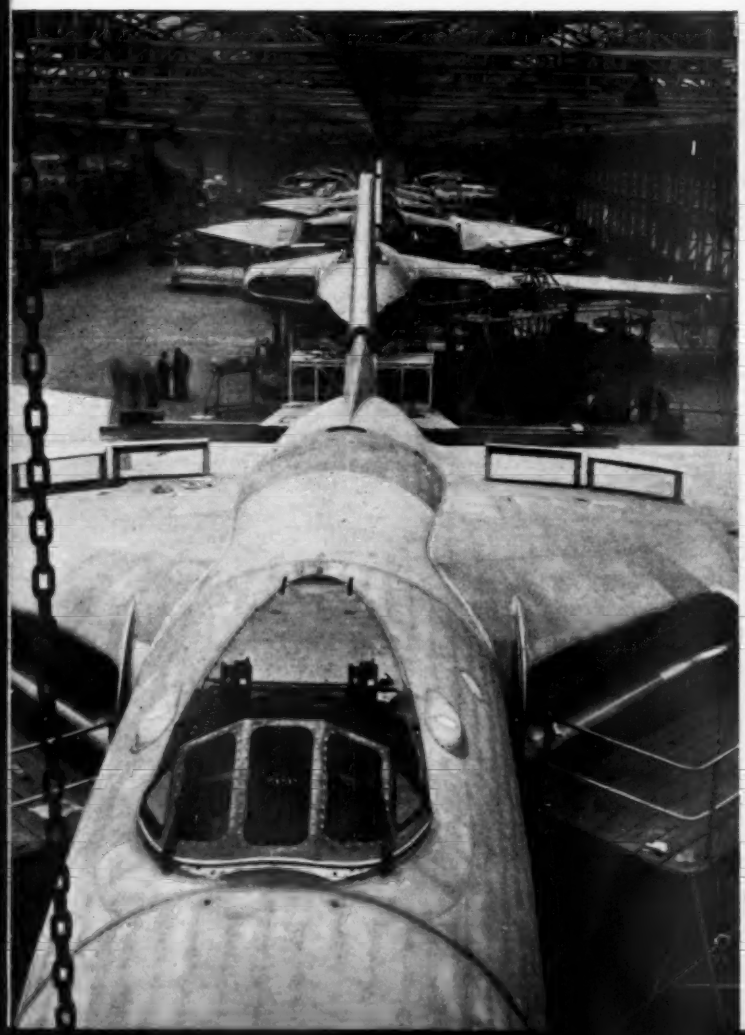
Radio talk during the show is terse. The pilot starts his engine(s) and then calls Farnborough tower, who reply, in this case, "Lightning clear to taxi," which Lightning does to the holding point on the taxi track, near the take-off mark. The waiting pilot listens to the tower passing its count-down to the pilot of, say, the Scimitar already airborne. At "Three minutes" the waiting pilot prepares to line up for take-off. He hears, "Lightning, line up," replies "Lightning Roger," and takes his place on the runway, still following the Scimitar's progress with eye and ear—"Scimitar, two minutes" . . . "Scimitar, one minute" . . . then Lightning begins to pour on power in readiness for "Lightning, take off—Scimitar down wind" . . . "maximum cold power, brakes off. . . ."



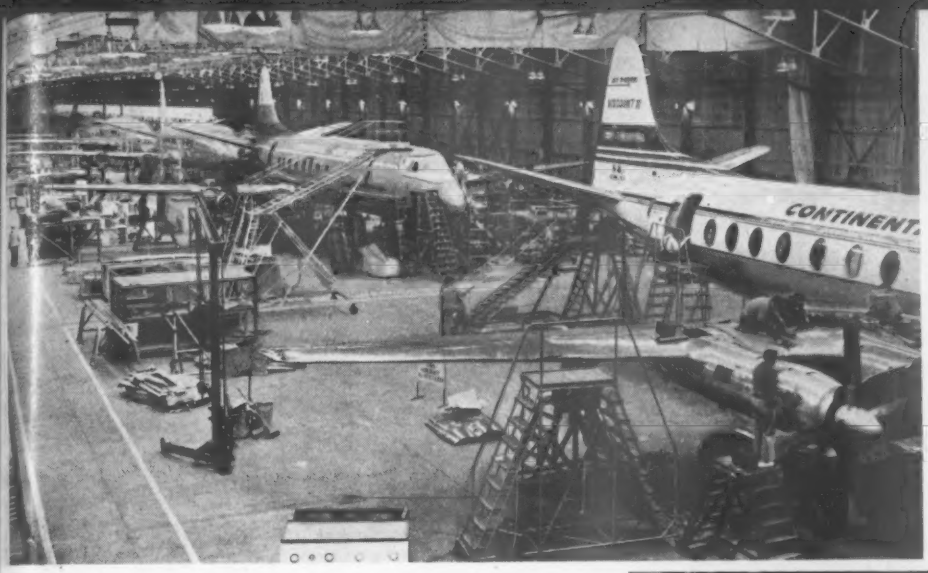
Left, Javelin all-weather fighters (two Armstrong Siddeley Sapphire turbojets) approaching final assembly at the Hucclecote works of the Gloster Aircraft Co., Ltd.

Seen, right, in the final assembly shop at Prestwick are Scottish Aviation Twin Pioneers for the R.A.F. On those nearest the camera the Alvis Leonides engines are yet to be installed.

Below, a line of Vulcan V-bombers (four Bristol Olympus turbojets) for R.A.F. Bomber Command at the Avro works at Woodford, Cheshire.

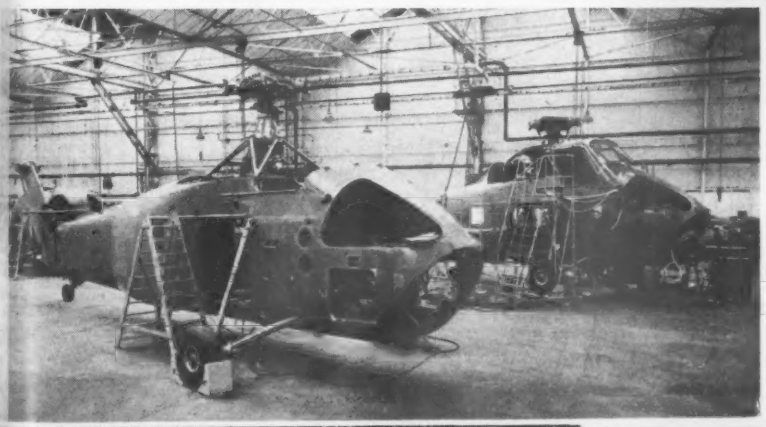


Below, Short Brothers and Harland, Ltd., is producing Bristol Britannias (four Bristol Proteus turboprops) under contract at Belfast. These are of the 300 Series; the one on the right is for Canadian Pacific Air Lines.




Left, Vickers Viscount 812s (Rolls-Royce Dart turboprops) being produced at Weybridge for Continental Airlines.

# PRODUCTION LINE SELECTION



Luton Airport is the scene, above, of Jet Provost T.3 production by Hunting Aircraft Ltd. This aircraft has an Armstrong Siddeley Viper turbojet.

Left, Wessex anti-submarine helicopters (Napier Gazelle shaft turbine) being produced for the Royal Navy at the Yeovil works of Westland Aircraft, Ltd.

Below, the Saro Skeeter light helicopter, powered by a D.H. Gipsy Major engine, in production at Cowes, I.O.W.

# The Fighting Services

## Missile Training Squadron

A MINISTRY OF DEFENCE statement last week announced the formation of the first R.A.F. squadron for working up crews and testing installation of intermediate range ballistic missiles. To be known as No. 77 Squadron and forming part of Bomber Command, it will be under the command of Gp. Capt. F. A. Willan, D.F.C., who has completed guided-missile courses at the R.A.F. Technical College, Henlow, and the R.A.F. Flying College, Manby.

The formation of No. 77 Squadron follows the progress made in Douglas Thor missile development and production, the training of operational personnel and the preparation of missile sites in the United Kingdom, since the Anglo-American agreement on the deployment of IRBMs in this country was signed in February of this year. The first of about 80 Thors is reported to be due in the United Kingdom towards the end of this month. The actual location where No. 77 Squadron is to be stationed has not been released.

During the work-up period a certain number of U.S.A.F. technical personnel will be attached to the squadron to provide further training on the site. The programme for training R.A.F. personnel at the Douglas Tucson plant in the United States is continuing, and the later Thor squadrons (the estimated total is four) will be manned entirely by the R.A.F., apart from a number of American civilian technical advisers.

## Squadron Standard Presentation

HER ROYAL HIGHNESS PRINCESS MARGARET is to present the Standard to No. 10 Squadron (Wg. Cdr. C. Owen, D.S.O., D.F.C., A.F.C.) at R.A.F. Cottesmore on October 21 next. Any ex-members of the squadron who wish to attend the ceremony are requested to contact the Adjutant, No. 10 Squadron, R.A.F. Cottesmore, Oakham, Rutland.

## Senior R.A.F. Postings

AIR VICE-MARSHAL G. SILYN-ROBERTS, C.B.E., A.F.C., at present Senior Technical Staff Officer at Headquarters, Bomber Command, is to become Director-General of Engineering at the Air Ministry in November. He will be succeeded at Bomber Command by Air Cdre. M. E. M. Perkins, C.B.E., who will take up the appointment with the acting rank of Air Vice-Marshal. Air Cdre. Perkins is Commandant of R.A.F. St. Athan.

Air Commodore C. M. Wight-Boycott, C.B.E., D.S.O., who has been Director of Operational Requirements (A) at the Air Ministry since January of this year, is to become Director of Operations (Forecasting and Planning) next month. In 1952 he commanded R.A.F. Colerne, and became Senior Air Staff Officer, Malta, in 1955.

At the Air Ministry Air Cdre. Wight-Boycott has been succeeded by Gp Capt. T. W. Piper, C.B.E., A.F.C., who has taken over the post with the acting rank of Air Commodore. Serving at Headquarters, Transport Command, since November, 1955, Gp. Capt. Piper commanded R.A.F. Dishforth in 1953 and served in M.E.A.F. from 1950 to 1953.

Group Captain D. W. Kingwell, D.S.O., R.A.A.F., who is to become Air Officer Commanding, R.A.A.F. Overseas Headquarters in London on September 30, with the acting rank of Air Commodore. Before his new appointment, Gp. Capt. Kingwell was Director-General Organisation at the Australia Department of Air.

FORMATION LEADERS.—The C.O.s of the two Naval Air squadrons—Nos. 800 and 803—representing their Service in the air display at Farnborough are leading their respective formations. Left, Lieut. Cdr. N. P. Perrett, R.N., who leads the No. 800 Squadron Sea Hawk aerobatic team, and, right, Cdr. J. D. Russell, R.N., who is leading the Scimitars of No. 803 Squadron.

## Service Catering

A NEW R.A.F. School of Catering is to be opened at R.A.F. Hereford on October 9. This will be the first Service establishment providing under one roof training for all catering personnel. With its opening, the No. 1 School of Cookery at R.A.F. Halton loses its identity and becomes part of the Hereford organization.

No. 2 School of Cookery at R.A.F. Innsworth closed down some months ago and amalgamated with No. 1 pending the opening of the new school. The R.A.F. Mess Staff's School is also moving to Hereford from Spitalgate, where it has been for the past 10 years.

## R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

**Group Captains:** A. D. Balmain, O.B.E., to Central Servicing and Development Establishment to command; H. R. Free, O.B.E., to Ministry of Supply; L. H. Snelling, A.F.C., to R.A.F. Record Office for administrative staff duties; A. F. Ward, O.B.E., to Central Signals Area, to command.

**Wing Commanders:** W. J. Swift to Teheran as Air Attaché (with acting rank of Gp. Capt.); R. J. Walker, D.S.O., to R.A.F. Hereford, to command (with acting rank of Gp. Capt.); C. S. Betts to R.A.F. Technical College, Henlow, as Chief Instructor; F. A. Buckingham to No. 25 M.U., for administrative duties; R. G. Churcher, D.S.O., M.V.O., D.F.C., to command No. 216 Sqn., R.A.F. Lyneham; G. Goodsell to Headquarters, Maintenance Command, for administrative staff duties; R. S. Harries, M.B.E., to Headquarters, Maintenance Command, for air staff duties; H. P. Hopkins, M.B.E., A.F.C., to R.A.F. Shawbury for air traffic control duties; E. James, D.F.C., A.F.C., to Headquarters, Fighter Command, for air staff duties; J. E. Lewis, O.B.E., to Headquarters, Allied Forces Mediterranean, for staff duties; J. E. M. Mould to Air Ministry for duty in the Department of the Air Member for Supply and Organization; B. J. Paul to R.A.F. Melksham, for administrative duties; B. E. Peck, D.F.C., to Air Ministry for duty in the Department of the C.A.S.; A. H. C. Roberts, D.S.O., O.B.E., D.F.C., to Air Ministry for duty in the Department of the C.A.S.; M. J. Underhill to Air Ministry for duty in the Department of the Air Member for Supply and Organization.

**Squadron Leader** F. K. Hindle, D.F.C., to the School of Administration, Bircham Newton, to instruct (with acting rank of Wg. Cdr.).

## Reunion

**R.A.F. Medical and Dental Branches.**—The annual dinner will be held at the Royal College of Surgeons, Lincoln's Inn Fields, London, on November 15. Applications for tickets, price 31s., should be made to the Hon. Sec., R.A.F. Medical and Dental Services Dinner Fund, Air Ministry (M.A.3), 1-6 Tavistock Square, London, W.C.1.

# Defence High Command

## by Air Marshal Sir Robert Saundby

FOR centuries the Admiralty and the War Office jealously maintained an independent existence, with few contacts and very little understanding of each other's problems.

It is for this reason that almost all our combined operations in the past were dismal failures—the most recent example being the abortive attempt to capture Gallipoli in 1915, in which the lack of co-operation between the Navy and the Army was almost incredible. If there were exceptions, such as Wellington's Peninsula Campaign or the capture of Quebec by General Wolfe and Admiral Saunders, they were of the kind that merely proved the rule.

The coming of military aviation in 1911, began to alter the picture. Here was a new development—aircraft were not then thought of as weapons—which was common to both Services. In 1912 the Royal Flying Corps, with military and naval wings, was set up, with a Central Flying School at Upavon, jointly controlled and staffed by the Navy and the Army. There seemed to be a great opportunity of bringing the two Services closer together, and of breaking down their historic attitude of aloof independence.

But, alas, it was not to be. After less than two years, just before the beginning of the First World War, the Admiralty broke away, and set up its own private air force, the Royal Naval Air Service. The Royal Flying Corps then became a corps of the Army.

This division of our air power into watertight compartments was a failure, and the realities of war compelled us to form a unified Air Service, responsible for purely air operations, and providing co-operation with the Army and the Navy.

Since the formation of the Royal Air Force in 1918, there has been a consistent effort to bring the three Services more closely together, to encourage them to study and understand each other's problems, and to improve co-operation at all levels.

This effort met with some success during the period between the two World Wars. The most valuable development was the Imperial Defence College, at which the future senior officers of all three Services were brought together, and in many cases valuable friendships were initiated. The Admiralty, however, was still concerned to safeguard its independence, and not very many of those who had been influenced by the Imperial Defence College course were selected for the more important Flag Officers' posts.

A more serious matter, perhaps, was the failure to formulate an agreed doctrine acceptable to all three Services. The disastrous Norwegian campaign and the tragic set-backs in Greece and Crete would have been avoided, for example, if the Air Staff doctrine, that no sea or land operation could succeed unless an adequate degree of air superiority could be provided, had been accepted.

By the time the Second World War ended the three Services —and the U.S. Navy, Army, and Air Force—taught in the hard school of practical experience, were in fairly close agreement. When I was at Bomber Command I used to give a lecture regularly to each course at all three Staff Colleges. In the early days of the War I was conscious of much disagreement, and narrow Service views were often expressed. Towards the end of the War a change had occurred, and the discussions showed that a large measure of agreement existed.

### A Return to Independence

Unfortunately the end of the War coincided with the development of high-speed jet aircraft, weapons of mass destruction, and rocketry of all sorts. Many new problems arose, and we had little or no operational experience to guide us. The floodgates of conjecture and controversy were opened wide once more, and the three Services began to develop their own independent views and doctrines.

In addition to independence of thought and doctrine, the Armed Forces have a tradition of financial independence. Up to the First World War the Navy had, by reason of its great prestige and our island status, by far the greatest pull in getting what it wanted from the Treasury. It had the advantage of well-organized popular support, and we were committed to maintaining the Two-Power Standard—that is a fleet equal to those of any two other Powers.

After 1918 the Navy was severely reduced as a result of various treaties limiting naval strength, but even so the Admiralty had little difficulty in securing more money than either the Army or the Air Force. The total expenditure on the three Services for the whole period between the two World Wars was: the Navy, £1,222 million; the Army £1,030 million; and the Air Force £456 million.

When rearmament began in 1934 each Service set about expanding as rapidly as possible. The Treasury quibbled and obstructed, as usual, but there was no attempt to decide on what was vitally necessary and what was not. Success depended on the ability to extract the money, by one means or another, from the Treasury. When, after the outbreak of the War, all the brakes—financial, political, and psychological —were removed, each Service set itself a target for expansion regardless of what the others were doing, and without any relation to our total national resources.

In the absence of any higher control, or any effective machinery for determining priorities, every Service had to join in this mad rush. It is true that there was at that time a Minister of Defence, but he was also the heavily burdened Prime Minister, responsible for the overall direction of the War.

### Inadequate Resources

When it became clear that our national resources were inadequate no effort was made to reduce the less important lines of production, but a general cut of 10% was imposed all round. The expansion of our Armed Forces ceased finally when our resources were fully committed.

In those days I used to wonder whether it was better to fight a war under our system, under which it was almost impossible to decide priorities and everyone had to rub along as best they could, or under the German system, whereby all sorts of decisions at the highest level were frequently taken, many of which proved to be wrong.

A study of the history of the War has convinced me that we were better off under our system, which usually produced a workable compromise, but that may be partly due to Hitler's genius for making wrong decisions and insisting, in the face of the highest military opinion, in having them put into effect.

After the War the Government decided to separate the functions of the Prime Minister and the Minister of Defence, and to appoint a full-time Minister. At first the Minister of Defence had little power and he mainly acted as a co-ordinator. But during the last 10 years a gradual shift of power has occurred away from the Service Ministries to the Ministry of Defence, and on January 24, 1957, the Prime Minister announced that the Minister's powers were to be further increased.

The Minister was given general authority to take decisions on matters of defence policy affecting the size, shape, organization and equipment of the Armed Forces. This involved a drastic curtailment of the powers of the Service Ministers. In addition, a Chairman of the Chiefs of Staff Committee was authorized, who would be borne on the strength of the Ministry of Defence. Hitherto the chair had been taken by the senior Chief of Staff.

The White Paper (Cmd. 476) presented to Parliament by the Prime Minister last July confirms this organization, and in addition introduces three new features. The composition and operation of the Defence Committee of the Cabinet is being changed in order to secure greater flexibility and efficiency.

A Defence Board is to be set up to assist the Minister in formulating defence policy and for dealing with inter-Service problems. Finally, the Chairman of the Chiefs of Staff Committee will in future be called the Chief of the Defence Staff, and will be responsible for keeping the Chiefs of Staff informed of the Minister's views, and the Minister informed of the views of the Chiefs of Staff. He will, in addition, be responsible for seeking from the Minister such decisions as may be required, and will represent H.M. Government, where appropriate, at international conferences.

The Joint Planning Committee, in their collective capacity, will be directly responsible to the Chief of the Defence Staff.

It is laid down that the Service Ministers and the Minister of Supply, when they wish to make proposals on any matter

affecting defence policy, should submit them to the Minister of Defence, though this will not prejudice their constitutional right to make submissions to the Cabinet.

While the supreme responsibility for defence rests with the Prime Minister and the Cabinet, defence problems at the highest level are normally handled by the Defence Committee, which meets under the chairmanship of the Prime Minister. Its membership is flexible, but broadly speaking it consists of all interested Ministers, including the Service Ministers. The Chiefs of Staff will attend its meetings, and may in addition be invited to full meetings of the Cabinet.

Thus, the White Paper says, the Chiefs of Staff are "in a position to fulfil their traditional duty to tender to the Government professional military advice."

The Prime Minister, introducing the White Paper in the House of Commons emphasized that it did little more than confirm arrangements which had been in operation for 18 months, and which the Government now believed to have been justified by practical experience. He said that the responsibility to Parliament of the Service Ministers and the Minister of Supply for the efficient administration of the Armed Forces and their supply remained unchanged. The Chairman of the Chiefs of Staff Committee, Sir William Dickson, had been appointed the first Chief of the Defence Staff.

While it is generally agreed that there must be some machinery for resolving inter-Service differences, when they arise, it is of supreme importance that the decision should be a correct one. It is far better to allow the Chiefs of Staff to work out a compromise than to impose a wrong decision. The main criticism of the new arrangement is based on the fear that too much power has been placed in the hands of two men—the Minister of Defence and the Chief of the Defence Staff.

The Minister will always be a civilian, though he may have had some experience in one of the Fighting Services; the Chief of the Defence Staff will be a distinguished sailor, soldier, or airman, and cannot avoid having a definite Service background. While it is true that a definite Service background need not involve a strong Service bias, it is also true that it may do so.

What, I think, all the Services fear is that a strong-willed, single-minded, dyed-in-the-wool sailor, soldier or airman could persuade the average Minister of Defence to accept his views, and could effectively overrule one or more of the Service Ministers. Perhaps people like Admiral Lord Fisher no longer exist, but if they do, and one of them became Chief of the Defence Staff, it would be a poor look-out for the War Office and the Air Ministry.

In addition, the Chiefs of Staff Committee will be unbalanced. It used to have one representative of each Service. Now one Service will be bound to have, in effect, two representatives, and one will be the powerful Chief of the Defence Staff.

It may be said that an aggrieved Service Minister can make a submission to the Cabinet if he is overruled on what he feels to be a matter of grave national importance. But the Minister of Defence can probably carry the Cabinet with him, since the Service Ministers are no longer members of the Cabinet and cannot put forward their case as amongst equals.

The Minister and his Chief of Staff could then make a final protest by resigning. But the Cabinet would be unsympathetic; and their resignations would be accepted. The departing Minister and Chief of Staff would be replaced by others more amenable. There might be a public outcry, but such demonstrations are seldom effective. If ignored, they soon die away and are forgotten.

In the debate in the House of Commons on July 28, Mr. Nigel Birch, who has had ministerial experience at the Air Ministry and the Ministry of Defence, said that it had been a mistake to appoint a separate chairman of the Chiefs of Staff Committee. That mistake had been made worse by turning him into a Chief of the Defence Staff, which had weakened the position of the Chiefs of Staff. He said that there was now one man to sign operation orders for the three Services, and that this contained the seed that could develop into the German *oberkommando* conception and practice.

It has always been a sound principle of our defence organization that military advice should be given to Ministers by those who will themselves be responsible for carrying out the operations which they advocate. This has always had a salutary and sobering effect. The danger now is that the Chief of the Defence Staff may force through proposals which are disliked by one or more Chiefs of Staff, who would have to put them into effect, and who would be responsible in the event of failure.

This certainly was the great defect of the German system in the late War. Hitler made his decisions, with or without the advice of those who would have to implement them, and then insisted on their being carried out. These decisions were often wrong, and sometimes disastrous, especially later in the War when things became difficult for the Germans. They undoubtedly contributed very largely to Germany's final defeat.

In contrast to this, Mr. Winston Churchill, though an unending succession of military projects, of varying degrees of practicability, stemmed constantly from his alert and active mind, never once overruled the Chiefs of Staff, though occasionally he may have over-persuaded them.

It would seem, therefore, that in the interests of achieving some central direction of defence policy, which is generally admitted to be necessary and desirable, we are in danger of setting up an organization which will work admirably so long as the Chief of the Defence Staff is able and genuinely impartial, but which might lead to calamitous errors if he is not. It is wrong that a matter so vital as our national defence should be exposed to this risk.

There have been persistent rumours, during the last few months, that these matters have been the subject of a "ministerial war" between the Minister of Defence and the Service Ministers. In the debate Mr. George Brown went so far as to say that if they were on speaking terms, it was only so because they were in the same administration. I believe this to be a great exaggeration, but there is little doubt that the Service Ministers, with some justification, feel that they are no longer masters in their own house. It is a strange thing when one of Her Majesty's Secretaries of State is excluded from the Cabinet and expected to submit proposals affecting the policy of his department through a superior Minister.

Nor is it altogether easy to reconcile this with the Prime Minister's assurance that the responsibility of Service Ministers to Parliament remains unchanged. It would seem to be inevitable that, having lost control of policy, their responsibilities will largely be confined to the day-to-day administration of their departments.

It is clear that the Government intends to give the new system a trial, and it may be that, like other elements of the British Constitution which are open to serious criticism on theoretical grounds, it will work well enough.

If, however, it proves to be defective, or is abused in practice, it is not unalterable—like the laws of the Medes and Persians—but flexible and amenable to change without the need for new legislation.

DEFENCE LEADERS.—Left to right, Marshal of the R.A.F. Sir William Dickson, G.C.B., K.B.E., D.S.O., A.F.C., who was appointed to the newly created post of Chief of the Defence Staff last July; the Chief of the Air Staff, Marshal of the R.A.F. Sir Dermot Doyle, G.C.B., K.C.V.O., K.B.E., A.F.C., and the Fifth Sea Lord, Vice-Admiral Sir Manley Power, K.C.B., C.B.E., D.S.O.

# Astronautics at Amsterdam—I

THERE have now been nine annual international congresses on astronautics; starting with Paris in 1950, they have been held in turn in London, Stuttgart, Zürich, Innsbruck, Copenhagen, Rome, Barcelona and now Amsterdam. Next year it will be London's turn again. The numbers who attend have been rising somewhat slowly year by year, and this time, according to the opening speech of Mr. C. Kolff, chairman of the Royal Netherlands Aero Club, 300 delegates have come from 24 countries; these countries are spread round the globe from Chile to Japan.

But there has been one noticeable feature this time: several leading figures in astronautics, who used to turn up only every two, three or four years, are now finding it imperative to come every year; even Wernher von Braun, who used to be expected year after year but was always prevented at the last moment from coming, has been allowed outside the United States at last.

The change must have been brought about by all these satellites circling the earth ever since the start of the last congress. However, this does not mean that the era of space travel has begun, as Professor J. Jongbloed, of Utrecht, was quick to point out to the delegates a few hours after the congress had opened. In a paper entitled "Medical Reflections on Space Travel," he asserted that modern rockets have as little to do with human travel through space, meaning the attainment of a destination followed by a safe return, as Lilienthal's glider had to do with air travel. The medical problems in particular, he warned, will be much more difficult to solve than those of aviation.

The latest medical problem, which was not even known to exist more than a few months ago, is that of the belt of intense radiation above about 1,000 km. (600 miles) whose existence has been shown by three of the Explorer satellites and the latest Sputnik. Unlike cosmic radiation, which avoids the equatorial zone, this newly discovered radiation belt lies between latitudes 30° N. and 30° S.

A brilliantly clear exposition of the probable nature of this radiation, and possible ways of mitigating its effects, was given by Professor S. F. Singer, of the University of Maryland, who was formerly scientific liaison officer with the U.S. Embassy in London, his most fruitful liaison having been with the British Interplanetary Society. He showed that the belt probably consists of high-speed protons which have been trapped in this belt by the earth's magnetic field and can only escape from it extremely slowly; individual protons may, in fact, stay in it for hundreds of years. The protons that have been fed into this belt are presumed to result from the decay of neutrons which, in turn, have been set free by cosmic ray bombardment of oxygen and nitrogen atoms in the high atmosphere.

Human travellers in this region would receive thousands of times the maximum permissible dose of radiation unless protected by 4 cm. thickness of lead; this would, of course, make a space-ship impossibly heavy but for the fact that, as Professor Singer suggested, a narrow ring of lead should give enough protection because the protons all perform circular motions in the same plane. But the belt probably extends out to 40,000 miles, beyond which the interplanetary magnetic field takes over; its maximum density should be some 6,000 miles out.

Prof. Singer's most intriguing suggestion was that, if his explanation is correct, it should be possible to get rid of virtually all these protons by absorbing them on to large artificial satellites of five to 10 metres diameter, because although the protons describe circles of about 100 kilometres radius, they do so in times of the order of a second. Ten such satellites, he estimated, should sweep up practically the lot in one year. But did some unbeliever in the audience whisper, "'I doubt it,' said the carpenter"?

There are two main medical problems in astronautics which cannot be fully investigated without going out into space: radiation is one, weightlessness is the other. But quite a lot can be discovered about weightlessness here below, and Dr. H. von Beckh, who has already done good work on the subject in the Argentine, has moved on to Holloman Air Force Base in the United States, where he has had jet aeroplanes producing weightlessness for half a minute at a time by flying along parabolic paths, technically described as "Keplerian trajectories."

Leonidas Sedov, of Russia, Vice-President of the International Astronautical Federation, giving the first lecture at the Amsterdam Congress.

In previous experiments of the kind, the "subjects" have been subjected to excessive *g* as the aeroplane pulls up from an initial dive into the ascending leg of the "weightless" parabola. This time, it occurred to von Beckh to subject them to just as much *g* after the weightless period as before, and he found that the excessive acceleration was then much less well tolerated. This means, apparently, that when descending to a planet's surface with rocket braking after a "weightless" voyage, the tolerable deceleration must be less than the initial acceleration was on take-off.

One "subject" was filmed trying to eat and drink while weightless, with amusing results, which were shown to the audience. He tried to drink out of a glass, but outsize drops spluttered away in all directions; he squirted water at his open mouth but could not help raising his weightless arm too high; then he got his teeth into some dried food, whereupon large chunks broke off and floated gently away, but he got the rest down.

At this meeting there were just 80 papers on the programme, compared with about 40 at each of the two previous congresses. The only thing to do was to divide them into two sections carrying on simultaneously, one for rocket technology and the other for everything else from navigation to physiology. And the only thing to do here is to mention a few outstanding contributions, since a bare list would alone fill all the available space.

First to make a notable impact in the rocket section was Dr. Leslie Shepherd, president of the British Interplanetary Society, from Harwell. He had yet another solution for the interplanetary vehicle of the future, which will be assembled in an orbit and start from there with a low but long-lasting acceleration, in contrast to the short, sharp kind needed for rising off the earth's surface.

Discussing "Electrical Propulsion Systems in Space Flight," which means that particles are accelerated electrically, instead of by combustion, before being shot out of the exhaust, Dr. Shepherd stated that they must acquire a speed of at least 100 km./sec., and give the vehicle an acceleration of 0.1 *g*, for practical results. After 8,000 words of close-knit discussion (at least in the printed version), he concluded his paper with a prophecy that: "Ultimately one might expect the electrical propulsion system to consist of a closed-cycle plasma generator coupled to a magnetic plasma accelerator." And plasma, these days, means a homogeneous conducting fluid made up of protons and electrons, as Prof. von Karman had explained in his opening address.—A.E.S.

# *Private Flying*

## H.J.C.'s CLUB COMMENTARY

SUPER-POU.—M. Henri Mignet visited the Elstree Flying Club on August 23 and demonstrated his HM-350 in a series of low-level aerobatics. He was accompanied by M. Roger Davaz, president of the Caen Aéro-Club. This model is to be produced at Caen.

*Photographs copyright "The Aeroplane"*

● QUITE a good crowd of people turned up at Luton on Sunday, August 24, for the flying display put on by the **Luton Flying Club.**

The show began at 15.00 hrs. with a fly-past by visiting club and private pilots, after which Mr. Dan Smith gave a fine demonstration of aerobatics in a Slingsby sailplane.

A particularly crazy flying turn was then given in a Tiger Moth by Mr. Barry Radley, an instructor with the club and deputy chief test pilot of Hunting Aircraft, after which a Swedish Saab Safir was exhibited by Mr. Phil Robins, of Kelvin and Hughes.

The C.F.I. of the club, Mr. David Campbell, then showed a pupil how to fly a Chipmunk, and the pupil showed the C.F.I. how he thought it ought to be done—always a popular event at a club meeting.

The Tiger Club did some tied-together flying; Barry Radley flew a Jet Provost T.2 to good effect. Then there was a height-judging competition, "Bish" aerobatics, and a demonstration of the Rollason-built Turbulent by Mr. Norman Jones.

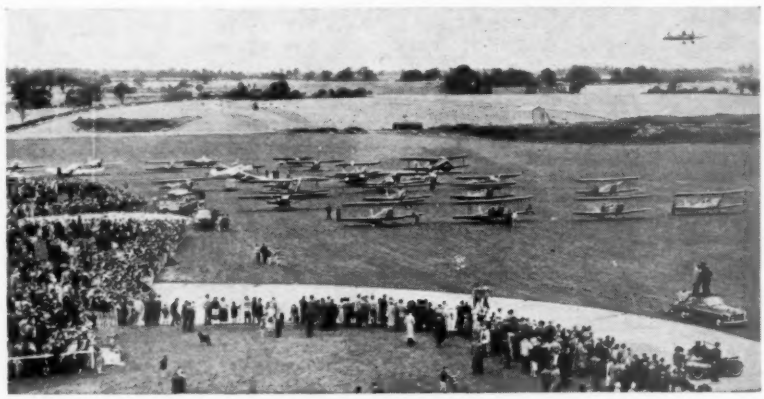
Radley then flew again, this time in a spectacular show of Chipmunk aerobatics, and the meeting ended with a demonstration by the yellow-and-black Rapide of the Automobile Association, which, in the hands of Mr. Don Whitehead, is being seen at many places throughout the country.

● AN informal garden party is to be held by the **Denham Flying Club** on Sunday, September 21, beginning at about 14.30 hrs.

Those who wish to attend, either by air or surface, are asked to contact the club at Denham aerodrome. (Telephone, Denham 2161.)

● AN ATTEMPT is being made in France to form a club of Autogiro enthusiasts to be known as L'Amicale des Anciens des Autogires. Details can be obtained from the Aéro-Club de France, 6 Rue Galilée, Paris, 16e.

LUTON VISTA.—The scene on August 24, Norman Jones airborne in the Turbulent.



# *Gliding Notes*

*by Dr. A. E. Slater*

BY TRADITION, Flight Cadets of the R.A.F. College at Cranwell are expected to go in search of adventure during their summer vacation. Those who choose gliding are allowed to take the College Gliding Club's equipment with them. Last year they took it to Camphill; this year 12 cadets with four officers are visiting the R.A.F. Wessex Gliding Club at Andover, again with their own equipment.

On August 11 Flt. Lt. Douglas Bridson, one of the Cranwell party, made Gold "C" distance from Andover to Great Driffield—actually 197 miles—flying the Skylark 2 which he shares with Frank Foster. He took 4½ hr. and made only five climbs, the highest being to 10,300 ft., using the insides of cumulo-nimbus clouds, which were separated by large cloudless areas. He qualified for Gold "C" height earlier this year in a flight from Dunstable.

Few 300-km. flights have been made across England in a northerly direction; there were only five among the 54 flights exceeding 300 km. made before the end of 1957. Southerly winds are so seldom unstable, as their lower layers get cooled down as they travel north.

There are two classic situations for producing an unstable southerly wind. One is "summer thunderstorm weather," with a surface south-easterly from the hot Continent overlaid by a cold south-westerly at high level which has come from the Arctic on a curved course. The other is when a complete Polar air mass has circulated round an Atlantic depression, finishing up with only a short northerly course which has not had enough time to stabilize it.

Bridson flew in the second of these situations, with a 15-knot south-westerly which gave him a cross-wind component, his course being N. by E. This air had reached its farthest south as much as three days earlier, in latitude 44° N., where the sea temperature would be about 66° F. But the land was hotter than this: maximum temperatures that afternoon were 69° F. at Boscombe Down, 71° F. at Watnall, and the same at Dishforth.

Wg. Cdr. N. W. Kearon was all set to do a cross-country from Andover the same day in the Wessex Club's Skylark 3, but he received a met. forecast that it would be no use.

* * *

HARLAND C. ROSS, the "R" of the famous RJ-5 sailplane, whose home is in Wichita, Kansas, has brought off the hat trick with three successive World's speed records for triangular courses in three consecutive days. All were two-seater records, made in the all-metal R-6 sailplane, which he designed and built himself, and all were done from Parker Airport, 13 miles west of Odessa, Texas, where he is spending a holiday. This particular Odessa is in the western high-level part of Texas, between 3,000 and 4,000 ft. up, in latitude 31° 50′ N.

On August 12, with Horace Jensen of Wichita as passenger, he flew round a 200-km. triangle (actually 141.5 miles) at 50.8 m.p.h., beating the previous record of 41.04 m.p.h. put up in 1955 by Henryk Zydorczak, of Poland, in a Bocian, and also setting up the first U.S. record of the kind. Launch was by aero-tow to 1,700 ft. and maximum height on the journey 10,000 ft.

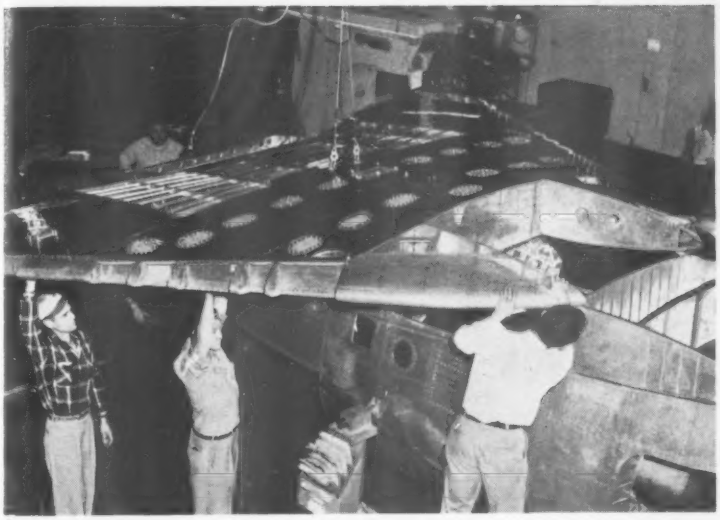
Next day it was the turn of the 300-km. triangular record to be broken: Ross covered a 203-mile course at 51.5 m.p.h. average. Previous World's record, 39.9 m.p.h. in 1956 by Zvonimir Rain of Yugoslavia in a Kosava. No previous U.S. record. Passenger, Paul Wilson of Wichita.

Finally, on August 14, Ross beat the 100-km. triangular record over a 65-mile course at 53.5 m.p.h. Previous World's record, 49.92 m.p.h. in 1952 by Ernst-Günther Haase in a Condor 4, and previous U.S. record, 41.023 m.p.h. in 1956 by Harold Hutchinson in a Laister-Kauffman.

* * *

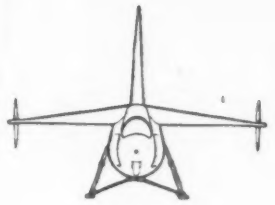
SOUTHDOWN GLIDING CLUB reports that, in the past three months' flying, "more has been achieved than during any other similar period in the club's history." Over Firle Beacon, with a moderate northerly wind, a Tutor easily climbs 1,300 ft. in the hill lift; nobody seems to have recorded the heights reached at the 1922 meeting at the same place but, as far as I can remember, Maneyrol's tandem monoplane looked to be about 600 ft. above the top at times, and that in a really strong wind.

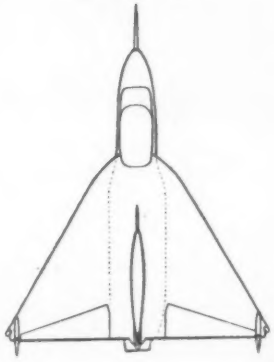
Launching has now been extended by the use of a contraption for carrying the cable over a fence. There was no fence there in 1922, but neither were there any winch launches—only bungey was used.

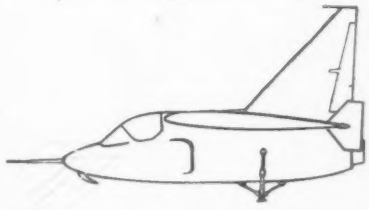


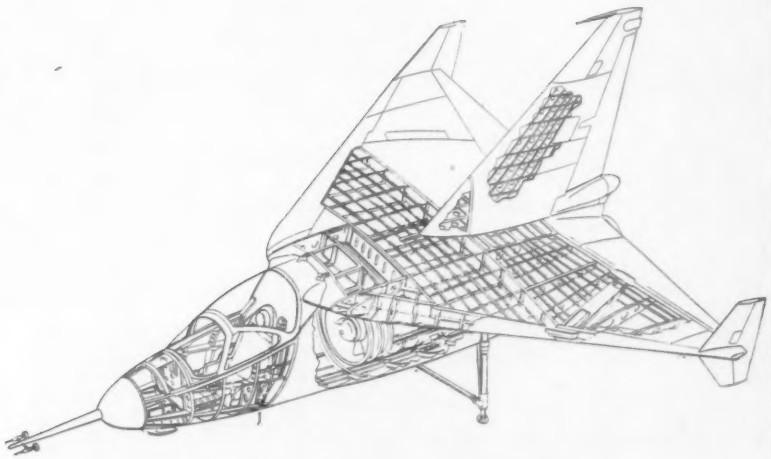
# Vertijet Details

Although unconventional in layout and conception, the Ryan X-13 Vertijet is comparatively conventional in its structural design—as shown in the cut-away sketch below. The Vertijet is powered by a Rolls-Royce Avon 200 turbojet of 10,000-lb. thrust.

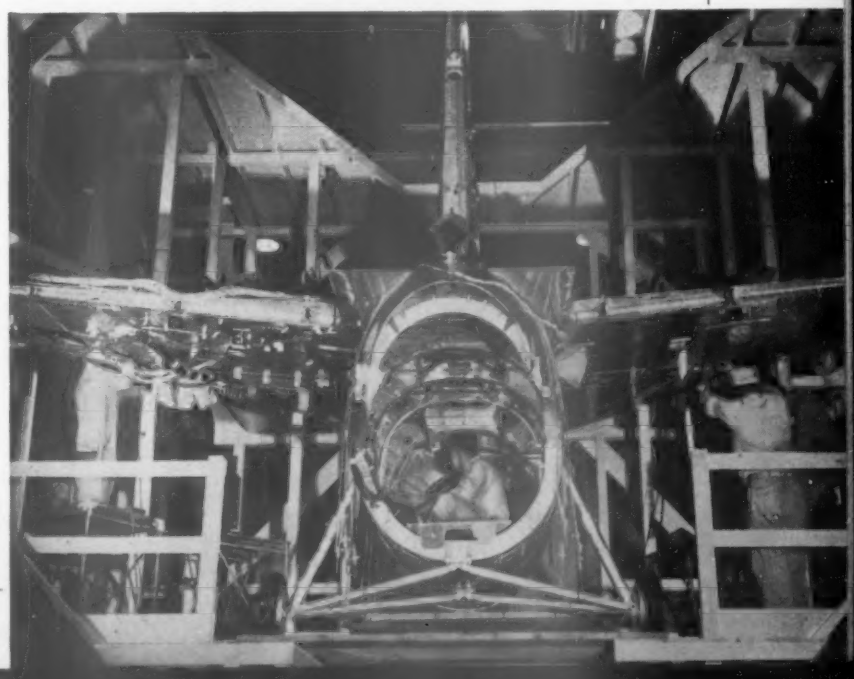








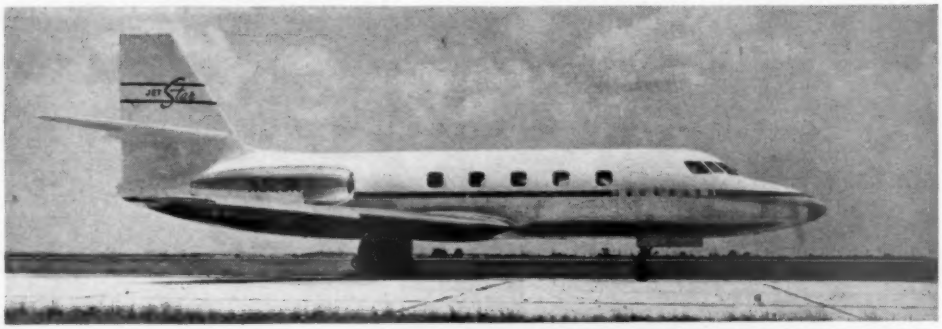
In the photograph at the top of the page the Vertijet's wing is being lowered on to the fuselage. Right, a rear view of the prototype structure in the assembly jig.

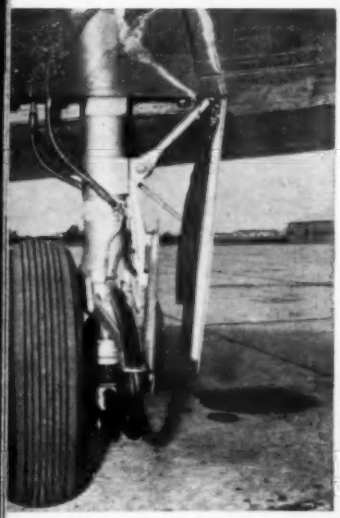


# New World Photo-News

*Pictures from Howard Levy*

Above, in the head-on view of the Jetstar it appears that the engines are in line with the wing; in fact, they are mounted at the rear of the fuselage.



Above, the second prototype Lockheed Jetstar military utility and executive transport aircraft, which has two Bristol Orpheus turbojets.

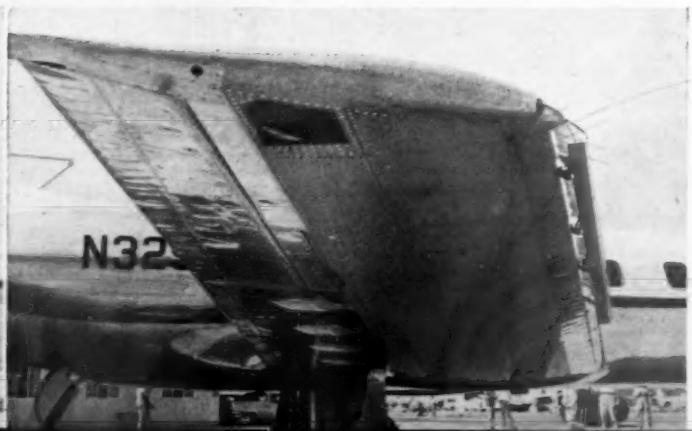
Left, a close-up of the port main landing-gear leg.

Above, a view of the cabin.

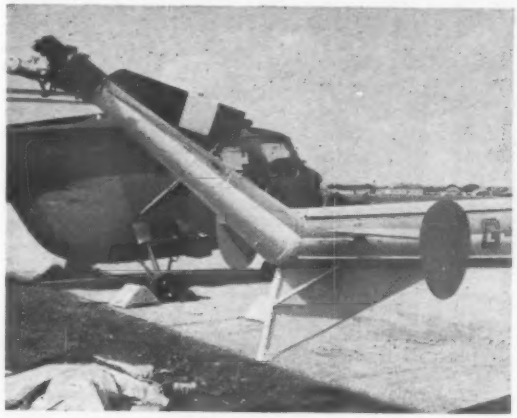
Left, the pilots' cockpit of the Jetstar.

Below, nose-gear details, showing landing lamps.

Below, this view shows the slots on the etstar's wing leading-edge.



# *Farnborough First Report . . . .*



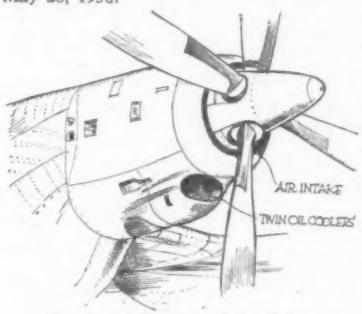
The tail-unit of the second Saunders-Roe P.531 general-purpose helicopter differs from the prototype in having end-plate fins.

(*Continued from page* 372)

1,000 lb. bombs and Palouste air portable starter pod. D.H.110 first flew September 26, 1951; first production Sea Vixen flew March 20, 1957.

**Shackleton MR.3.**—A. V. Roe and Co., Ltd. Type 696. Four 2,450 h.p. Rolls-Royce Griffon 57 engines. XF701. Production aircraft for Coastal Command. First flew September 2, 1955.

**Short SC.1.**—Short Bros. and Harland, Ltd. Five 2,010 lb.s.t. Rolls-Royce R.B.108 turbojets. XG900. First of two jet-lift research aircraft shown in static park, with horizontal flight engine only installed. Fitted with Folland ejection seat. First flew (horizontal take-off), April 2, 1957; first vertical take-off (by second prototype, in gantry) May 26, 1958.




Engine installation of the Tyne-Ambassador.

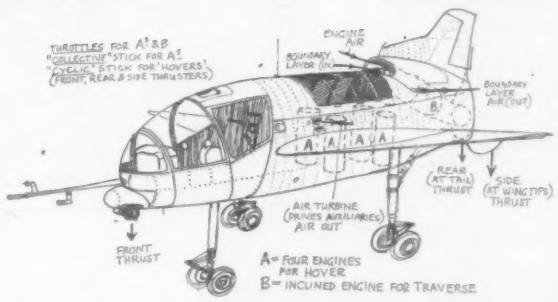
**Skeeter 12.**—Saunders-Roe, Ltd. P.501. One 215 h.p. de Havilland Gipsy Major 215 engine. XL762. Standard production model for the British Army. Skeeter (Mk. 6) first flew August 29, 1954.

**Skeeter 51.**—Saunders-Roe, Ltd. P.501. One 215 h.p de Havilland Gipsy Major 215 engine. SC502. Standard production model for the German Kriegsmarine.

**Sycamore.**—Bristol Aircraft, Ltd. Type 171. One 520 h.p. Alvis Leonides 524/1 engine. CC-063. Standard production aircraft for Luftwaffe, equipped to carry two stretchers and fitted with rescue winch. First flight (Type 171) July 24, 1947.

**Twin Pioneer 1.**—Scottish Aviation, Ltd. Two 540 h.p. Leonides 514/8A engines. G-APLW. Production aircraft used as company demonstrator, equipped for executive rôle. First flew June 28, 1955.

**Twin Pioneer CC.1.**—Scottish Aviation, Ltd. Type SA.B3. Two 520 h.p. Alvis Leonides 128 engines. XM289. Military version of the Twin Pioneer, in production for the R.A.F. Bomb-aimer's position in front fuselage and carrying four supply canisters on racks under the stub wings.


THROTTLES FOR A's R.B.
"COLLECTIVE" STICK FOR A's
"CYCLIC" STICK FOR 'HOVERS'
(FRONT, REAR & SIDE THRUSTERS)
ENGINE AIR
BOUNDARY LAYER (IN)
BOUNDARY LAYER AIR (OUT)
REAR (AT TAIL) THRUST
SIDE (AT WINGTIPS) THRUST
AIR TURBINE (DRIVES AUXILIARIES) AIR OUT
FRONT THRUST
A = FOUR ENGINES FOR HOVER
B = INCLINED ENGINE FOR TRAVERSE

Although fitted with the tail-mounted engine only, the Short SC.1 at Farnborough has provision for the four RB.108 VTOL turbojets and the controls for vertical flight as fitted to the other SC.1 at Belfast.

*Drawing copyright "The Aeroplane"*

Alternative loads shown, for each wing, were one 1,000 lb., two 500 lb., two 250 lb. or eight 19 lb. fragmentation bombs. Equipped in combination paratroop/casualty evacuation rôle. First flew August 28, 1957.

**Tyne-Ambassador.** — Rolls-Royce, Ltd. A.S.57. Two Rolls-Royce Tyne turboprops. G-37-3. Second prototype Ambassador (G-AKRD) used as flying test-bed for Tynes, fitted with interim-standard engines. First flew August, 1958.

**Ultra Light Helicopter.**—The Fairey Aviation Co., Ltd. One 258 e.h.p. Blackburn-Turboméca Palouste 505 air generator. G-AOUJ. Fairey development aircraft, shown in Naval colours in anticipation of adoption of this type for shipboard anti-submarine duties. First flew August 14, 1955.

**Vampire T.11.**—The de Havilland Aircraft Co., Ltd. Type 115. One 3,500 lb.s.t. de Havilland Goblin 35 turbojet. WZ587. Standard production aircraft (1,581 hours in R.A.F. service), shown with alternative underwing loads of four 60-lb. rockets, one 500-lb. bomb, one 1,000-lb. bomb, four practice bombs or one 160-gal. drop tank each side. First flew November 15, 1950.

**Victor B.1.**—Handley Page, Ltd. H.P.80. Four 11,000 lb. Armstrong Siddeley Sapphire 200 (A.S.Sa.7) turbojets. XA930. Production aircraft, carrying long-range tanks on each wing, and flight-refuelling probe above cockpit. First prototype flew December 24, 1952; first production, February 1, 1956; with long-range tanks, August 27, 1958.

**Viscount 812.**—Vickers-Armstrongs (Aircraft), Ltd. Four 1,990 e.h.p. Rolls-Royce Dart 525 (R.Da.7/1) turboprops. N248V. Ninth production 810-series for Continental Airlines. First Viscount flew July 16, 1948; first 812 flew February 14, 1958.

**Vulcan B.1.**—A. V. Roe and Co., Ltd. Type 698. Four 13,000 lb.s.t. Bristol Olympus 104 turbojets. XA903. Development aircraft for Avro Blue Steel stand-off bomb, in flying display only with development round of the weapon stowed half-externally in the bomb-bay. Also XA891, standard production aircraft. Vulcan first flew August 30, 1952.

**Vulcan B.2.**—A. V. Roe and Co., Ltd. Type 698. Four 16,000 lb.s.t. Bristol Olympus 200 turbojets. XH533, first production Mk.2 with increased span and area, thin-section wing and modified elevon-type control. Also VX777 Mk.2 aerodynamic prototype in static park. Prototype first flew Aug. 31, 1957. Production Mk.2 flew Aug., 1958.

**Wessex HAS.1.** — Westland Aircraft Ltd. Type W.B.5. One 1,800 s.h.p. Napier Gazelle N.Ga.13 shaft turbine. XL727. First production aircraft, designed for the Royal Navy in the anti-submarine rôle. First flew (with Gazelle) May 17, 1957; first production Wessex flew June 20, 1958.

**Westminster.**—Westland Aircraft Ltd. Two 2,400 e.h.p. Napier Eland 229 shaft turbines. G-APLE. Prototype "Utility" model of the Westminster design, with bare fuselage and early engines. First flew June 15, 1958.

**Whirlwind HAS.7.**—Westland Aircraft Ltd. Type W.A.5. One 715 h.p. Alvis Leonides Major 155 engine. XL880. Production model of the anti-submarine Whirlwind, with weapons bay in fuselage and "dipping asdic" submarine detection equipment.

**Widgeon.**—Westland Aircraft, Ltd. Type W.B.1. (S.51 Series 2.) One 520 h.p. Alvis Leonides 521/1 engine. G-AKTW. One of the two prototype Widgeon conversions from Dragonfly airframes. First flew August 23, 1955.

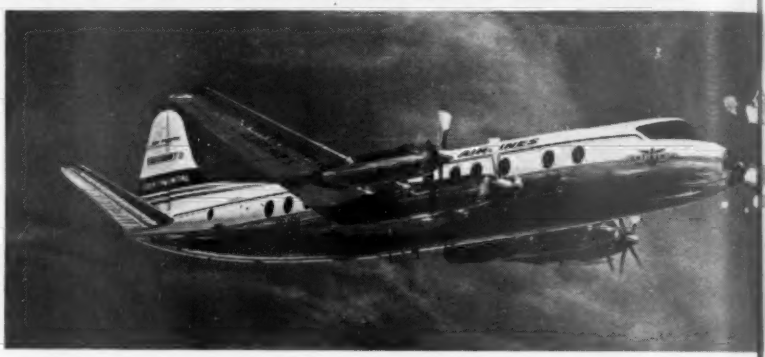
Two pictures showing the air-brake mechanism of the Handley Page Victor.

*Photographs copyright "The Aeroplane"*

BRITAIN'S FASTEST.—Above, the Rolls-Royce Avon-powered Fairey F.D.2, seen here with nose section lowered, still holds the British air speed record of 1,132 m.p.h.

*Photographs copyright "The Aeroplane"*

# Airborne for Farnborough—2



FOR FOREIGN SERVICE.—Above, one of Britain's best-selling aircraft is the Vickers Viscount. Here is an 812, one of 15 ordered by Continental Airlines of the U.S.A.

DOUBLE STING.—Left, two Folland Gnat light fighters (Bristol Orpheus turbojet), that nearest the camera carrying 12 3-in. rockets and two 66-gal. drop tanks. The other is for the Finnish Air Force.

IN NEW GUISE.—Below, this Airspeed Ambassador test bed has two Rolls-Royce Tyne turboprops. It flew for the first time last month.

*Farnborough First Report . . . .*

# Powerplants on Show

**Armstrong Siddeley P.181.**—Bristol-Siddeley Engines, Ltd. Redesigned since first shown last year, this 1,020 s.h.p. shaft turbine now has a two-stage axial compressor with final centrifugal stage, annular reverse-flow combustion chamber, two-stage turbine and single-stage free-power turbine. Power take-off at front or rear of engine. Not yet run.

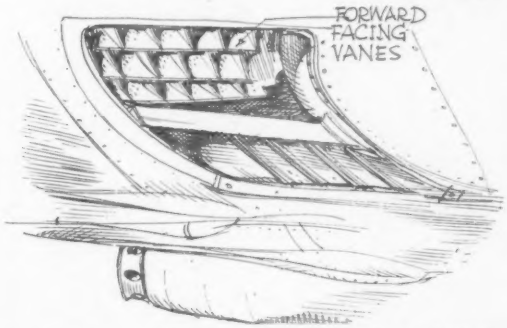
**Armstrong Siddeley P.182.** — Bristol-Siddeley Engines, Ltd. Turboprop version of P.181, giving 1,100 s.h.p. and 200 lb. thrust with a cruise s.f.c. of 0.65 lb./e.h.p./hr. Not yet run.

**Armstrong Siddeley PR.23.**—Bristol-Siddeley Engines, Ltd. New liquid-propellent rocket of 500-lb. thrust. Trimmer unit for LRBM; could also be used for reaction-control of aircraft at great heights. Not yet run.

**Dart R.Da.7.**—Sectioned Dart of the 1,910 s.h.p. type used in the Viscount 806 and 810, Argosy, Dart Herald, Friendship and Gulfstream. Darts have now been in scheduled revenue-earning operation for more than five million hours. B.E.A. have recently announced a 2,000-hr. overhaul life for their Darts. First run July, 1956. Type test September, 1956.

**Double Mamba A.S.M.D.8 Mk. 102.**—Bristol-Siddeley Engines, Ltd. Powerplant of the Gannet AEW Mk. 3, shown for the first time. The 3,600 s.h.p. A.S.M.D.8 replaces the A.S.M.D.3 as standard production Double Mamba. Jet pipes re-located to suit fuselage of the new Gannet. First run April, 1956. Type test February, 1958 (4,089 e.h.p.)

**Double Scorpion N.Sc.D.1.**—D. Napier and Son, Ltd. Twin-barrel rocket engine




The starboard thrust reverser on the D.H. Comet 3B's outer Rolls-Royce Avon.

*Drawing copyright "The Aeroplane"*

**Avon R.A.24R.**—Rolls-Royce, Ltd. One of the Avon Series 200 military turbojets fitted to the Lightning, Sea Vixen, Scimitar, Canberra PR.9 and Hunter F.6. Shown with fully variable petal-type afterburning nozzle and intermediate jet pipe as used in the Lightning. Without this in operation the thrust is 11,250 lb. Avons have flown more than one-and-a-half-millon hours. First run February, 1954. Type test July, 1956.

**Avon R.A.29 Mk. 524.**—Rolls-Royce, Ltd. The 10,500-lb. thrust civil Avon for the Comet 4. The only Avon so far to have a 16-stage compressor and three-stage turbine. Overhaul life is now 1,000 hr. The R.A.29/5 will give 13,300-lb. thrust. First run March, 1956. Type test March, 1957.

**Blackburn A.129.**—Blackburn and General Aircraft, Ltd. First seen this year, the A.129 is an Artouste 600 with a two-stage axial compressor added upstream of the centrifugal compressor. Drive is taken out at the rear through a free power turbine and a Turmo gearbox. Initially rated at 840 s.h.p., the engine will be developed to give 950 s.h.p. after turbine modifications. First run July, 1958, as a turbojet; August, 1958, as shaft turbine.

**Conway R.Co.10 Mk. 505.**—Rolls-Royce, Ltd. Lowest rating of the present series of Conway by-pass engines, the civil R.Co.10 for the Boeing 707-420 has a guaranteed minimum thrust of 16,500 lb. It is shown with a side-venting thrust-reverser and a noise-reducer, both in Nimonic 75 sheet, and has a complete control system. First run July, 1957. Type-test July, 1958.

as fitted to the English Electric Lightning and some R.A.F. Canberras. Burners are fuel-cooled. First run June, 1956.

**Eland N.El.6.**—D. Napier and Son, Ltd. Sectioned 3,500 e.h.p. Eland as fitted to the Canadair 540 and re-engined Convair 340/440 transports. First run November, 1956. Type test February, 1958.

**Eland N.El.3.**—D. Napier and Son, Ltd. The 3,000 e.h.p. engine for the first Fairey Rotodyne. Shown with hydraulic clutch and auxiliary compressor to supply air to rotor-tip jets added to the N.El.1 to make it an N.El.3. First run (N.El.1) August, 1952. Type test (N.El.1) May, 1956.

**Gazelle N.Ga.3.**—D. Napier and Son, Ltd. Sectioned example of the 1,800 s.h.p. Gazelle fitted to the Westland Wessex and Bristol 192 helicopters. First run December, 1955.

**Gipsy Major 215.**—The de Havilland Engine Co., Ltd. Fitted with turbo-supercharger which maintains 220 b.h.p. in I.C.A.N. + 30° C. tropical conditions up to 4,000 ft. First run February, 1957. Type test November, 1957.

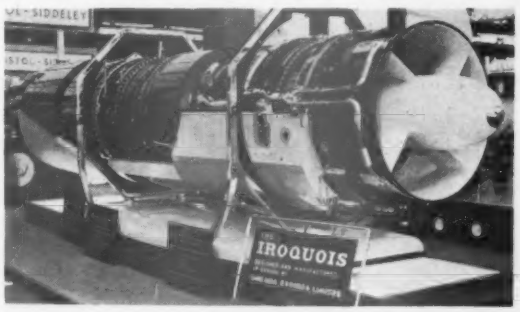
**Gnome D.Ge.1.**—The de Havilland Engine Co., Ltd. First showing of the General Electric T58 1,000 s.h.p. shaft turbine engine being built under licence as the D.H. Gnome. Coupled and turboprop versions will also be available. First run (T58) April, 1955. Type test (T58), October, 1957.

**Gyron D.Gy.2.**—The de Havilland Engine Co., Ltd. Standard engine of 20,000-lb. thrust (29,000 lb. with afterburning). Still under P.V. development for Hawker P.1121. No other applications known. First run September, 1954.

**Gyron Junior D.G.J.1.**—The de Havilland Engine Co., Ltd. The 7,000-lb. thrust engine for the Blackburn NA.39. Fitted with compressor-bleed manifold for air supply to wing and tailplane blowing and with an air-intake extension. First run August, 1956.

**Gyron Junior D.G.J.10.**—The de Havilland Engine Co., Ltd. Higher-powered Gyron Junior with probable five-figure thrust at high supersonic speed. Afterburner (shown separately) operates at 2,000° K. and gives 40% additional thrust. Differs from D.G.J.1 in having larger diameter combustion system and turbine; a fabricated steel (instead of cast light alloy) intake; a separate oil tank on the port side; and a Dowty fuel system underneath. Apparently has a nine-stage compressor with variable-incidence inlet guide vanes and first row of stator blades, and two-stage turbine. First run October, 1957.

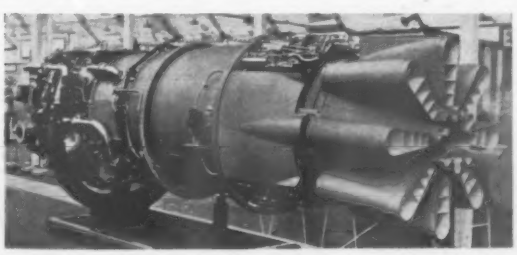
**Iroquois Mk.1.**—Orenda Engines, Ltd. Similar to engine shown for the first time last year, but with front spool of compressor turning over and afterburner nozzle-area being varied. The afterburner shown has run for 800 hours. Thrust probably about 22,000 lb. or about 30,000 lb. with close-coupled afterburner in operation. Over 6,000 hours of test-bed and subsonic flight operation including more than two hours above Mach 1.5 and some time at Mach 2.3. Re-lights have been 100% successful at simulated heights well above 60,000 ft. at both subsonic and supersonic speeds. Delivery of first two engines for the Avro Arrow 2 is imminent. Licence to build in the U.S.A. acquired by Curtiss-Wright. First run November, 1954.




The Orenda Iroquois has achieved more than 6,000 hr. of test-bed, subsonic and supersonic flight operation.

**Leonides 510 Series.**—Alvis, Ltd. The 560 b.h.p. engine for fixed-wing aircraft such as the Agusta AZ-8L, Beaver, Provost, President and Twin Pioneer. First run February, 1956. Type test November, 1956.

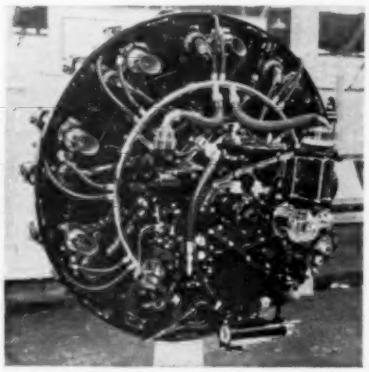
**Leonides 530 Series.**—Alvis, Ltd. Long-stroke version of Leonides, shown for the first time. Now rated at 600 b.h.p., but power will later be increased. Suitable for Twin Pioneer. First run October, 1957. Type test August, 1958.



Among Rolls-Royce exhibits is the Conway R.Co.10 by-pass turbojet with noise-reducer.

*Photographs copyright "The Aeroplane"*

## *Farnborough First Report . . . .*



The Alvis Leonides 530, shown for the first time, is a long-stroke version of earlier models.

**Leonides Major Mk.155.** — Alvis, Ltd. Standard helicopter powerplant as for Westland Whirlwind. De-rated to 770 b.h.p., for helicopter use, from 885 b.h.p. First run June, 1955. Type test begun March, 1956.

**Leonides Major Mk.702.**—Alvis, Ltd. Standard 885 b.h.p. engine as fitted to the first Handley Page Heralds. First run July, 1953. Type test November, 1957.

**Napier N.R.E.11.**—D. Napier and Son, Ltd. Sectioned rocket engine for missiles. Bi-propellent engine using hydrogen peroxide oxidant and kerosene fuel.

**Napier N.R.E.17.**—D. Napier and Son, Ltd. Production version of 2,000-lb. thrust missile rocket engine. Incorporates latest developments in uncooled combustion chambers and exhaust nozzles to make it suitable for quantity production.

**Napier N.R.E.19.**—D. Napier and Son, Ltd. Helicopter rotor-tip boost rocket as fitted experimentally to the Saro Skeeter. Tip-thrusts available from 20 lb. to 100 lb. First flight-tested August, 1956.

**Olympus B.O.7R Mk. 201.**—Bristol-Siddeley Engines, Ltd. Most powerful Olympus; type tested at 17,000 lb. thrust. Fitted with Bristol Solar fully variable afterburning which gives a total static thrust of 24,000 lb. To be used in the Avro Vulcan B.2, succeeding the 16,000 lb. thrust B.Ol.6 Mk. 200. First run April, 1958. Type test May, 1958.

**Orpheus B.Or.3 Mk. 803.**—Bristol-Siddeley Engines, Ltd. Standard NATO light fighter engine now of 5,000 lb. thrust. B.Or.2 (Gnat Mk. 1) compressor blading has been adopted as standard for the B.Or.3 to make it suitable for operation at all heights. Thrust/weight ratio is the highest of any production engine in the World. Latest application of the Orpheus is the Handley Page H.P.113 laminar-flow research transport. First run December, 1956. Type test May, 1957.

**Palas 600.**—Blackburn and General Aircraft, Ltd. Basic gas generator unit of the Blackburn-Turboméca range: a 390 lb. thrust turbojet. First run February, 1954.

**Proteus 765.**—Bristol-Siddeley Engines, Ltd. Sectioned engine of the type fitted to the Britannia 320 Series. The 4,445 e.h.p. Proteus 765 has higher take-off power and better fuel consumption than earlier engines. First run July, 1957. Type test July, 1957.

**Rolls-Royce R.B.145.**—Rolls-Royce, Ltd. New engine based on the R.B.108 (2,010 lb. thrust) VTOL engine. Apparently, a seven-stage axial compressor and single-stage turbine. Thrust 2,750 lb.; not a VTOL engine. Suitable for trainers and executive aeroplanes. Not yet run.

**Sapphire A.S.Sa.7R.** — Bristol-Siddeley Engines, Ltd. Shown with afterburner fitted, as used in the Gloster Javelin FAW. 8. Without an afterburner the engine is rated at 11,000 lb. thrust and is used in the Javelin FAW.7 and Handley Page Victor B.1. The simple afterburning system increases thrust by 12% and comes into operation from 20,000 ft. up to the operating ceiling of the aircraft. First run July, 1952. Type test June, 1957 (10,670 lb.).

**Spectre D.Spe.4.**—The de Havilland Engine Co., Ltd. Fixed-thrust (about 8,000 lb.) rocket for A.T.O. of Victor and Vulcan bombers. Also forms upper half of Double Spectre D.Spe.D.1, probable powerplant of first Avro stand-off bomb. First run May, 1955.

**Spectre D.Spe.5.**—The de Havilland Engine Co., Ltd. Variable-thrust (about 8,000 lb.) rocket for piloted aircraft such as the Saunders-Roe S-R.53. Also forms lower half of Double Spectre D.Spe.D.1. First run February, 1957.

**Thor Mk. 101.**—Bristol-Siddeley Engines, Ltd. Ramjet engine for the Bristol-Ferranti Bloodhound guided weapon. First ramjet to go into service in the U.K.

**Triple Scorpion N.Sc.T.1.**—D. Napier and Son, Ltd. Shown for the first time; three-barrel version of original Scorpion for missiles or aircraft.

**Turmo 600.**—Blackburn and General Aircraft, Ltd. Shaft turbine of 450 s.h.p. as used in Saunders-Roe P.531 and Kaman K.17 helicopters. Can be operated on wide-cut gasoline, kerosene or Diesel fuel. Constant speed of a helicopter rotor is obtained by governing the free power turbine. First run June, 1955. Type test December, 1956.

**Tyne R.Ty.1.**—Rolls-Royce, Ltd. First version of the Tyne turboprop, now fitted to a Tyne-Ambassador test-bed. A second Tyne-Ambassador will be used by B.E.A. for operating experience. The later R.Ty.11 for the Vickers Vanguard will be of 5,525 e.h.p. The R.Ty.12 is specified for the Canadair CL-44D. First ran June, 1957.

**Viper A.S.V.11.**—Bristol-Siddeley Engines, Ltd. At 2,460 lb. thrust, the most powerful of the Viper series. Probably for latest Jindivik target drones De-rated to 2,000 lb. thrust, the A.S.V.10 has lower s.f.c. for executive transports. First ran January, 1957.

# Guided Missiles Displayed

**Aerodynamic Test Vehicle.**—A. V. Roe and Co., Ltd. A test vehicle on the company's stand with Perspex panels to reveal internal arrangement. Very similar in overall appearance to published photographs of the Avro stand-off bomb; presumably a scale model. Two jet orifices suggest a twin power unit.

**Bloodhound.**—Bristol Aircraft Co., Ltd. Surface-to-air anti-aircraft defence weapon for the R.A.F. Two Thor ramjets boosted for the launching phase by four wrap-round solid rocket motors. Semi-active homing. Weapon shown as complete operations system with zero-length launcher, loading trolley and control-post caravan. Demonstrated in g.w. park by R.A.F. team.

**Fireflash.**—Fairey Aviation Co., Ltd. Air-to-air operational training weapon for the R.A.F. Powered by two separating solid-propellent booster rockets; missile coasts to target as a beam rider. Weapon has a proximity fuse. Several examples on display in g.w. park with Service demonstrations of loading, unloading and systems testing.

**Firestreak.**—de Havilland Propellers, Ltd. Air-to-air weapon for R.A.F. and Royal Navy interceptor and all-weather fighters. Single solid-propellent rocket motor; no booster rockets. Infra-red homing head. Not shown in g.w., but on company's stand and on English Electric Lightning, D.H. Sea Vixen, and Gloster Javelin in flying display.

**General-purpose Vehicle.**—Short Brothers and Harland, Ltd., and Elliott Brothers (London), Ltd. Test vehicle for guidance and control system development. Example shown is a recoverable round with parachutes and flotation gear. Powered by a single liquid-propellent rocket engine with eight wrap-round solid rockets for launching-phase boost.

**Pye Anti-tank.**—Pye, Ltd. Short-range portable anti-tank missile built as a private venture for infantry use. Single solid-propellent sustainer rocket motor and tandem solid-propellent boost rocket. Line-of-sight command link guidance through wires to operator's control column. Shown in the g.w. park.

**Seaslug.**—Sir W. G. Armstrong Whitworth Aircraft, Ltd. Surface-to-air anti-aircraft defence weapon for the Royal Navy; example shown is a propulsion test vehicle. Single solid-propellent sustainer rocket motor boosted for launching by four wrap-round solid rockets. Shown on shipboard-type zero-length launcher and with shipborne test equipment; in the g.w. park.

**SX-A5.**—Short Brothers and Harland, Ltd. Test vehicle for a small surface-to-air anti-aircraft weapon being developed under M.o.S. contract for the Royal Navy. Single solid-propellent rocket motor, no wrap-round boosters. Probably command-link guidance system. Shown on company's stand.

**Thunderbird.**—The English Electric Co., Ltd. Surface-to-air anti-aircraft weapon for the Army and the R.A.F. Example shown described as "genuine"—previous ones displayed having been test rounds. Single solid-propellent main sustainer rocket motor boosted for launching by four wrap-round solid rockets. Semi-active homing. Shown with transporter and zero-length launcher and operated by a Royal Artillery team in the g.w. park.

**Vickers Type 891.**—Vickers-Armstrongs, Ltd. Small, portable short-range anti-tank weapon for infantry use. Private venture project. Single solid-propellent sustainer rocket motor; no booster rockets. Line-of-sight command link guidance through wires to operator's control column. Weapon shown complete and broken down into component parts in the g.w. park.

Bristol Aircraft's Bloodhound, is an imposing feature of the Missile Park.

To be used by the Army and the R.A.F., the English Electric Thunderbird is a surface-to-air missile.

# FEATURED AT FARNBOROUGH

*On this and the following seven pages we publish a selection of cut-away drawings by THE AEROPLANE artists showing some of the more recent fixed-wing and rotary-wing aircraft and aero-engines which are to be seen at the S.B.A.C.'s flying display and exhibition at Farnborough, either on the ground or in the air.*

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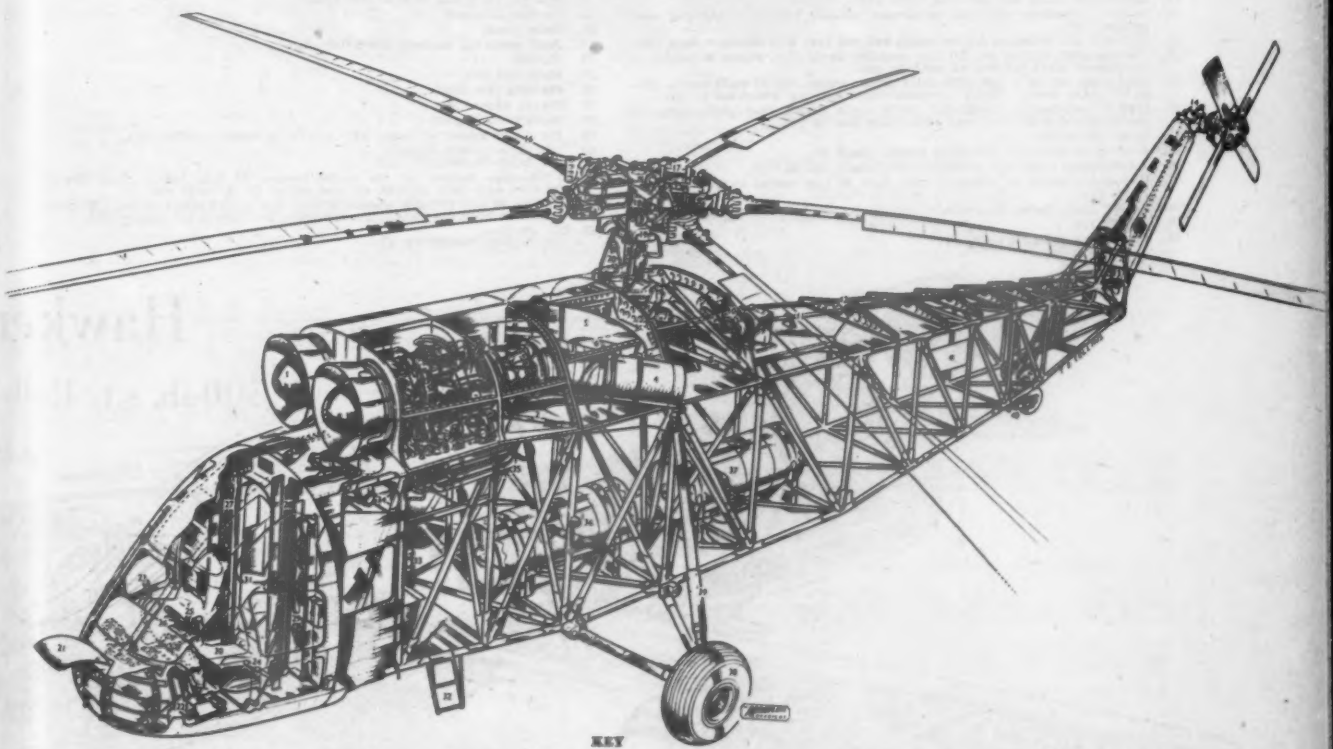
## Westland Westminster (Utility Prototype)

### Two Napier Eland E229 Shaft Turbines



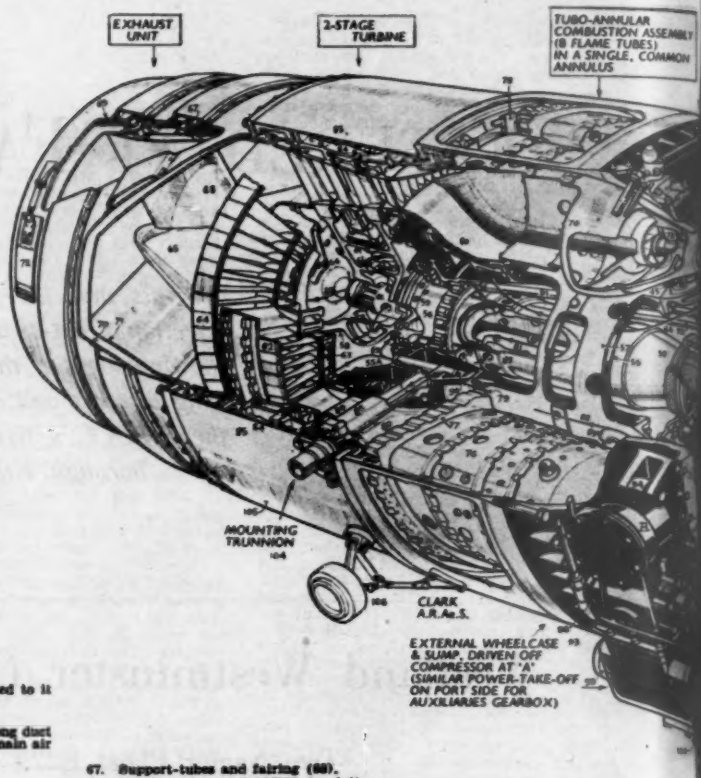
KEY

1. Two Napier Eland E229 rear-drive turbine engines.
2. Main engine mounting.
3. Single-sided engine exhaust pipe.
4. Airframe-mounted section of exhaust pipe.
5. Fireproof bulkhead.
6. Engine drive shaft inside casing.
7. Main gearbox.
8. Tubular mounting structure for main gearbox.
9. Belt-driven fans and oil coolers for main gearbox.
10. Hydraulically-operated transmission brake.
11. Tail-shaft.
12. Tail-shaft support beams and flexible-bearing supports.
13. Intermediate gearbox.
14. Tail-rotor gearbox.
15. All-metal tail rotor 15 ft. in diameter.
16. Main rotor, 73 ft. in diameter, with five all-metal blades.
17. Main rotor hub with offset flapping hinges.
18. Rotor-blade drag damper.
19. Main rotor-control swashplate assembly.
20. Duplicated flying-control servo-jacks.
21. Nose access door.
22. Rudder pedestal assembly
23. Cyclic-pitch stick
24. Collective-pitch lever
25. Engine-speed selection levers.
26. Engine-clutch operating levers.

(22–26: Controls duplicated for two pilots)

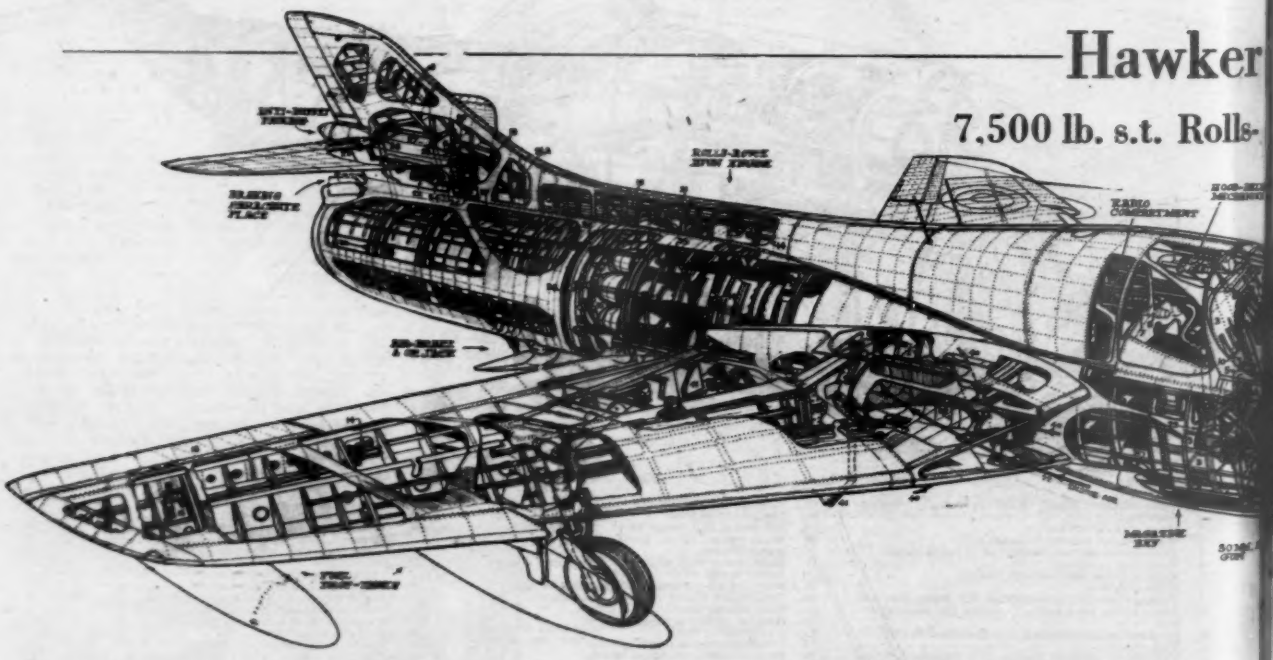
27. Flying-control push-pull rods.
28. Engine control push-pull rods.
29. Duct for electrics with cable connectors.
30. Co-pilot's seat with fore-and-aft adjustment.
31. Flight test observer's seat.
32. Entry steps.
33. Fire-extinguisher bottles.
34. Engine oil-cooler and fan.
35. Engine oilpipes to tank and clutch.
36. Front fuel tank—260-gal. capacity.
37. Rear fuel tank—250-gal. capacity.
38. Main undercarriage.
39. Air-oil shock-absorber strut.
40. Castoring tail undercarriage with spring centring.

# The 200 Series Rolls-Royce Avon Turbojet


EXHAUST UNIT
2-STAGE TURBINE
TUBO-ANNULAR COMBUSTION ASSEMBLY (8 FLAME TUBES) IN A SINGLE, COMMON ANNULUS
MOUNTING TRUNNION
CLARK A.R.Au.S.
EXTERNAL WHEELCASE & SUMP, DRIVEN OFF COMPRESSOR AT 'A' (SIMILAR POWER-TAKE-OFF ON PORT SIDE FOR AUXILIARIES GEARBOX)

**KEY**

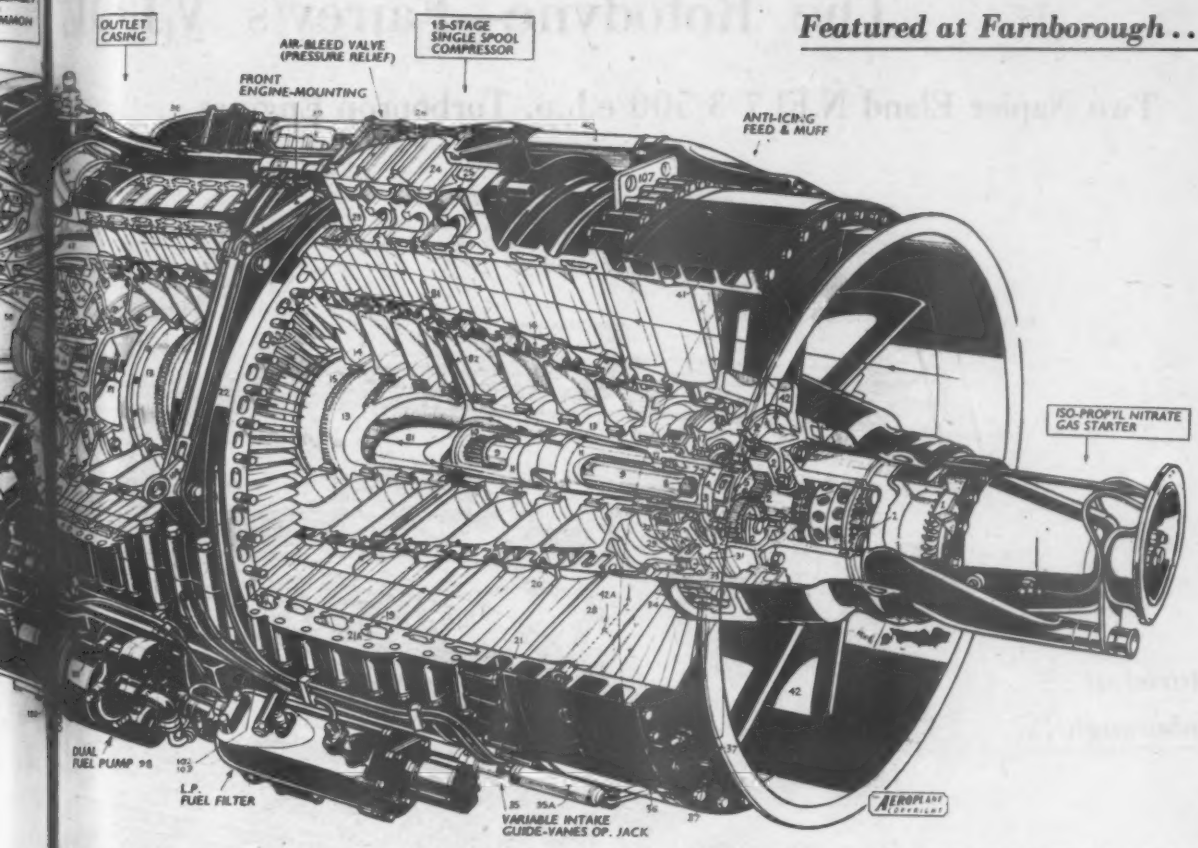
1. Gas starter reduction gear; drives through reduction gear 2 to ratchet ring 3, engaging pawls 4.
5. Pawl hinge.
6. Pawls stop when pawl falls back.
7. Pawls take drive on to 7, spline 8, spring-drive shaft 9, spline 10, final-drive shaft 11, spline 12 and compressor shaft 13.
14. Rotor discs engaging splines (15).
16. Rotor blades pinned to discs.
17. Compressor front (roller) bearing.
18. Compressor rear (ball) bearing.
19. Stator blades.
20. Stages 1, 2, 3, 4, 5 are shrouded. Stages 6 to 14, plus stage 15 outlet guide-vanes, are unshrouded.
21. One-piece air intake casing.
21a. Compressor casing front section (magnesium alloy) up to and including stage 6.
22. Compressor casing rear section (aluminium alloy) stages 7 to 15.
23. Air out through stator blades.
24. Carbon inserts in a slide-valve 25, vent to atmosphere via three gauged orifices 26.
27. Air-bleed op. valve.
28. Variable-incidence inlet guide vanes.
29. Incidence-control ring running on rollers 30 in casing 31. (Rollers 30 retained by face-ring 32.)
33. Fibre carriers rock vanes 28 via arms 34 when ring 29 is moved-on.
35. Operating jack 35 rocks three vanes (one direct [36] and two linked to it [37]) (the inner arms 34 of these three do move the ring 29).
35a. Spring buffer.
38. Gate valve meters hot compressor delivery air (valve operator 39) along duct (40) into muff (41) down through intake-spokes (42) and out into main air of compressor. Also down hollow guide vanes, as (42a).
42. Eight-vent compressor outlet casing.
44. Combustion snout and securing screw (45).
46. Internal wheelcase carrying compressor tail-end (47) in compressor rear bearing (18).
47. Tail-end (47) embraces turbine-shaft ball end (48) with retainer-piece (49).
50. Turbine shaft-splined at (50) into coupling sleeve (51), which is coupled to compressor shaft tail-end at toothing (52).
53. Gear-train off teeth (53) with shaft drive through one of eight spokes (54) of the outer casing. Shaft extension drives external wheelcase at (A).
55. Intermediate-casing (backbone) (with inner casing 55a) picking up off casing (43) and carrying rear main roller bearing (56).
57. Inner air casing.
58. First-stage rotor disc bolted to turbine shaft 59.
60. Second-stage rotor disc coupled to first-stage disc at (61).
62. First-stage blades in groups of two, each fir-tree rooted to disc (locking-plates 63).
64. Second-stage blades in groups of two blades, each fir-treed and locked.
65. Inner cone.
66. Cooling-air deflector plate.
67. Support-tubes and fairing (68).
69. Spacing wires and ALFOL insulation.
70. Insulation casing.
71. Outer cone.
72. Joint retaining segment inspection door.
73 Burner.
74. Main fuel line.
75. Starting fuel line.
76 (Eight) flame tube.
77. Baffle plate (eight).
78. Eight-arm spider off casing (57) at (79) to support baffles (77).
80. Discharge nozzles (eight).
(A) LOW-PRESSURE AIR.
81. Fifth-stage cooling air via vortex-reducer 82 into hollow shaft thence forward and right through aft and out at 83 to merge with 84.
84. Airflow 81 out through wheelcase (46) into intermediate casing (55) with extension flows up eight arms to turbine and nozzle-box casing (86).
86, 87. Omitted.
(B) HIGH-PRESSURE AIR.



## Hawker

## 7,500 lb. s.t. Rolls-

## *Featured at Farnborough...*




88. Fifteenth-stage air around outside of flame tubes and nozzle boxes with branch 89.
89. Air between intermediate casing (55) and inner-air casing (57), through tube (90) to front, mid and rear faces of turbine discs.
91. Oil scavenge from rear bearing.
92. Oil feed to rear bearing.
93. External wheelcase hung at (94) mounting a tachometer (95), centrifugal breather (96), guide-vane ram governor pump (97), duct fuel pump (98), oil pump driven from fuel pump (99), oil-level window (100).
101. The external wheelcase (93) is one-piece with a flat, slab-shaped sump (101) fitting close up under compressor. Sump carries front-bearing scavenge filter (102), oil-replenishing coupling (103) and oil-pressure transmitter.
104. Mounting trunnion off the steel turbine and nozzle-box casing (106).
106. Maintenance run-in rollers.
107. Slinging lug.
108. Engine front mounting with pick-up at 108.

**Technical Data (R.A.28)**

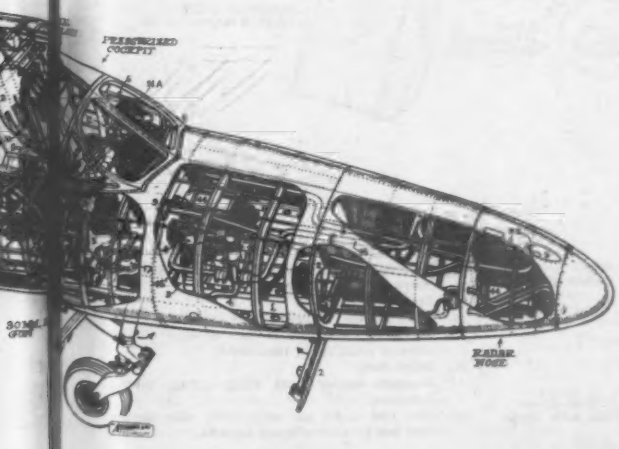
**Dimensions.**—Diameter, 41.5 in.; length with exhaust cone, 113.3 in.

**Weight.**—Dry, 2,990 lb.

**Performance.**—Max. sea-level static thrust, 10,000 lb. at a specific fuel consumption of 0.86 lb./lb./hr.

# Hunter T.Mk.7

## Royce Avon Turbojet



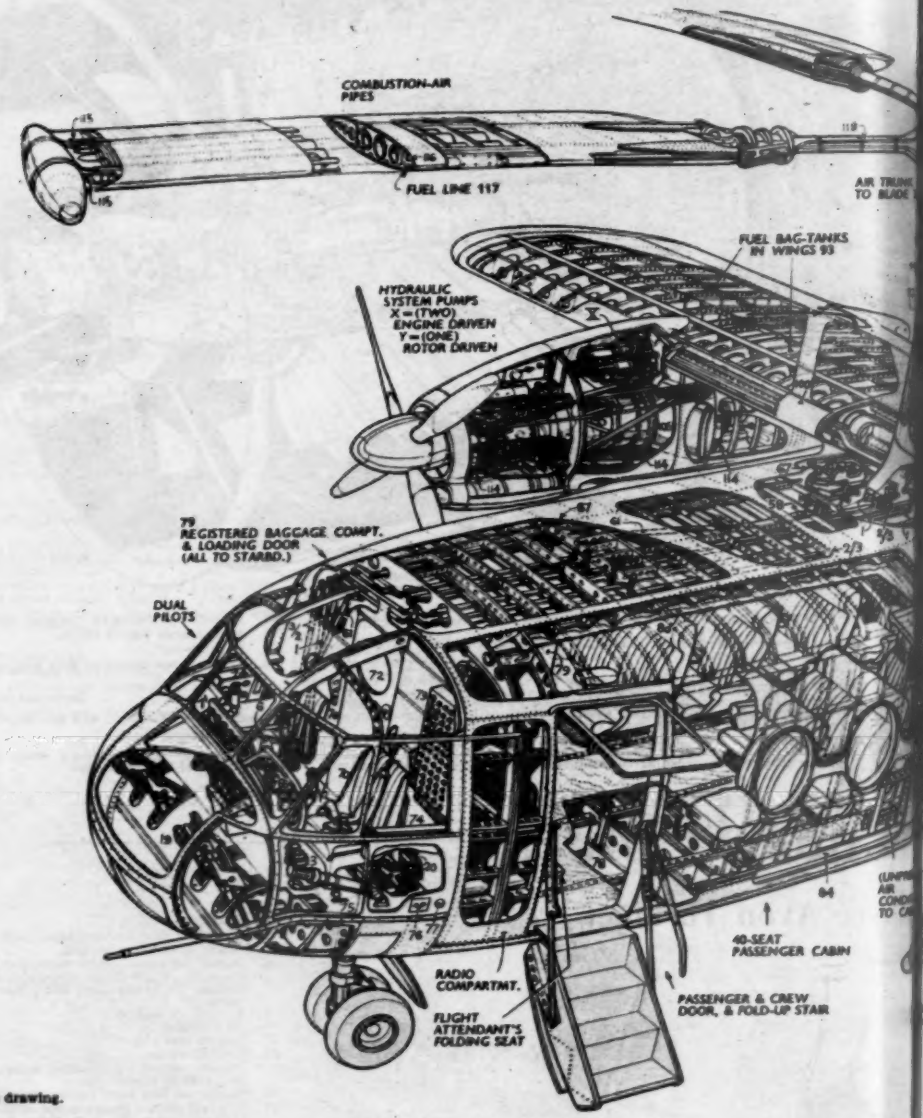

**KEY**

1. Nosewheel well.
2. Nosewheel door and operating jack.
3. Limits of pressure-cockpit.
4. Cockpit pressure-control valve and outlet (with bleeds for radar cooling).
5. Four-branch air supply to cockpit from engine-compressor bleed for anti-misting (6), pressurizing and heating via water-separator (7) and regulator valves (8).
9. Ram air to cockpit.
10. Air extractor.
11. Ejector seat gun.
12. Dual throttles.
13. Aileron control from control columns (13), rods (14) and hydraulic servo-jack (15) to aileron (16).
17. Rudder control from rudder bars (17) and rods (18).
22. Elevator control from control columns (13), rods (21), servo-jack (22) and elevator shafts (33) with spring-feel unit (19) anchored at (30) and connected to rods (21) at bell-crank fulcrum (21A).
24. Servo jack is anchored at (24) for servo operation. For direct manual control from control column to elevator the anchorage (24) is released and jack (22) made to act as a solid part of control-rods (21) (same principles for aileron control).
25. Tailplane variable-incidence actuator (25) anchored at (36) operates on to tailplane front spar at (27).
26. Tailplane hinge-point.
29. (In cockpit) four emergency-air bottles for undercarriage and flap operation and anti-*g* system air.
30. Inverters.
31. Air cooling to cannon.
31A. Port gun-sight.
32 and 33. Not used.
34. Engine bearing-cooling duct (each side).
35. Engine mountings.
36. Fuselage joint with interconnections between stringers.
37. Jet pipe transport rail.
38. Wing root engine air intake.
39. Counteur lines to indicate duct profile.
40. Boundary-layer air bleed.
41. Undercarriage wheel-well and door.
42. Undercarriage combined operating jack and side stay.
43. Not used.
44. Radar in nose with cooling-air pipes (45).

# The Rotodyne—Fairey's VTOL Air

## Two Napier Eland N.El.7 3,500 e.h.p. Turboprop Engines

***Featured at Farnborough ...***


COMBUSTION-AIR PIPES
FUEL LINE 117
AIR TRUNK TO BLADE
FUEL BAG-TANKS IN WINGS 93
HYDRAULIC SYSTEM PUMPS X=(TWO) ENGINE DRIVEN Y=(ONE) ROTOR DRIVEN
79 REGISTERED BAGGAGE COMPT. & LOADING DOOR (ALL TO STARBD.)
DUAL PILOTS
40-SEAT PASSENGER CABIN
RADIO COMPARTMT.
PASSENGER & CREW DOOR, & FOLD-UP STAIR
FLIGHT ATTENDANT'S FOLDING SEAT

**KEY**

Note: certain numbers not used in this drawing.

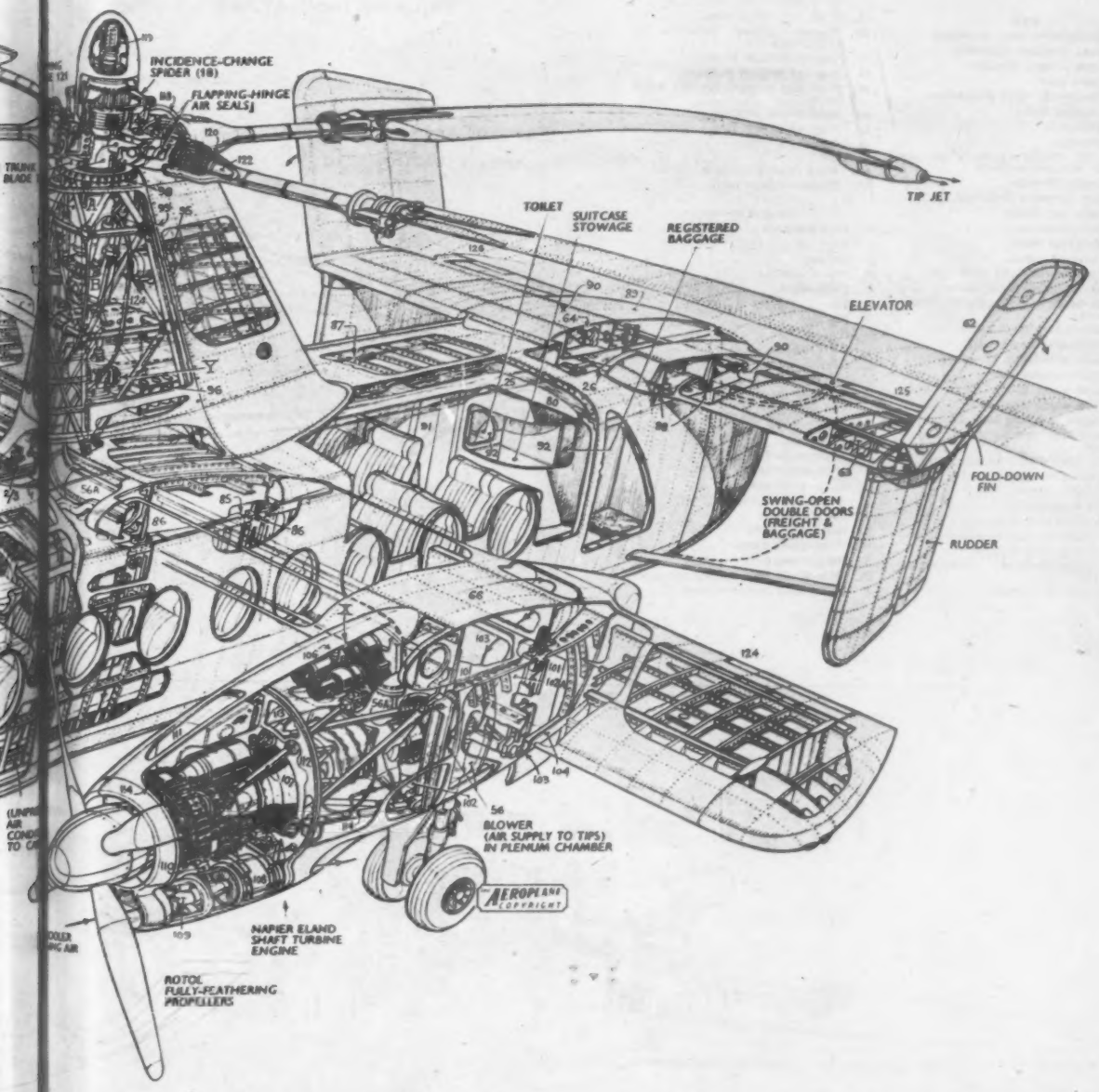
**Control System**

- A. Cyclic pitch lateral control jacks.
- B. Cyclic pitch fore-and-aft control jacks.
- 1. Cyclic pitch lateral control circuit.
- 2. Cyclic pitch fore-and-aft control circuit.
- 3. Collective pitch control circuit.
- 6. Control integrator box.
- 18. Tilting swashplate and arms.
- 19. Rudder pedals to operate rods 20, cables 25 and rods 28.
- 56A. Air trunk to rotor head.
- 58. Spring.
- 61. Control rod.
- 62. Upper fins.
- 63. Pin-raising operating jacks.
- 64. Elevator electric actuator.
- 66. Air to auxiliary compressor.

**Fuselage and Wing**

- 70. Pilots' seats.
- 71. Instrument board and cowl.
- 72. Windowed door.
- 73. Fuse panel.
- 74. Secondary control panel (each side).
- 75. Release for adjustable rudder pedals.
- 76. Ground-supply electrics.
- 77. Telephone ground intercom.
- 78. Floor beams and seat rails.
- 79. Registered baggage compartment.
- 80. Ceiling (with controls above).
- 81. Light-luggage rack.
- 82. Not used.
- 83. Conditioned air to cabin from unit in pylon.
- 84. Top and bottom angle-longerons with break 86.
- 86. Wing fixings.
- 87. Longitudinal stringers with frame-stabilising strips (and see in pylon).
- 88. Tailplane fixings.
- 89. Roofing-piece between two elevators with universal joints (89) to each elevator on the elevator cross-shaft (anti-bind).
- 91. Toilet door.
- 92. Baggage compartment right across, behind bulkhead.
- 93. Two fuel tanks per wing, each with elgtric fuel pump; with collector tank 94.

# Airline Transport




96. Hydraulics header-tank and reservoir (actually starboard side) 96.
97. Tubular pylon with head-anchorage at 98.
98. Fairing fixings (one fixed, two sliding, to take racking strains off fairings).
100. Hinged leading edge for services-runs.

**Nacelles**

101. Pick-ups to wing.
102 and 102A. Bulkheads from plenum chamber (entry hole at 103).
103. Undercarriage pick-up off 102 and horizontal 104.
104. Spider (off engine supports) carries compressor 56 and elbow to air trunk 56A.
105. Engine jet pipe (heat-screened from 104).
106. Auxiliaries gearbox carrying generator, hydraulics pump and tachometer, with drive (107) from engine.
108. Oil cooler.
109. Cooling-air fan, driven (110) off engine.
111. Oil tank.
112. Firewalls at 112 and 102 with roof (tray) 113.
114. Fire extinguishers and sprays rings.

**Rotor Head**

115. Tip-jet fixings to spars.
116. Balancing rod and fuel line 117 in front spar.
118. Fuel line inboard.
119. Slipring assembly (electrics to blades).
120. Roller bearings carry blade-ends on stub shafts from flapping hinges, 121.
122. Air pipe to blades.
123. Main support-bearing casing with gear drive off blade-hub to give drive 124 down to hydraulics system pump Y.
124. Hydraulics pump drive shaft.
125. Servo tab (port elevator).
126. Hand tab (starboard elevator).

# Avro Vulcan B.Mk. 1

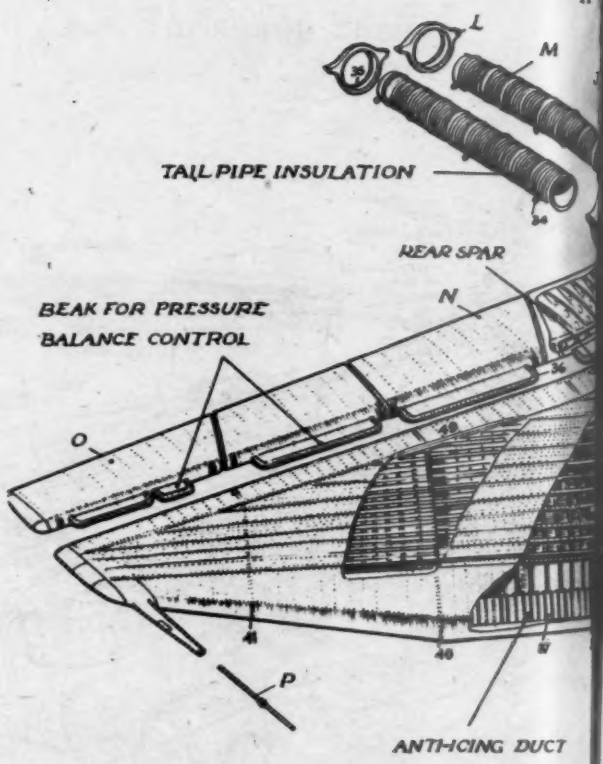
## Four 12,000-lb. s.t. Bristol Olympus Turbojets

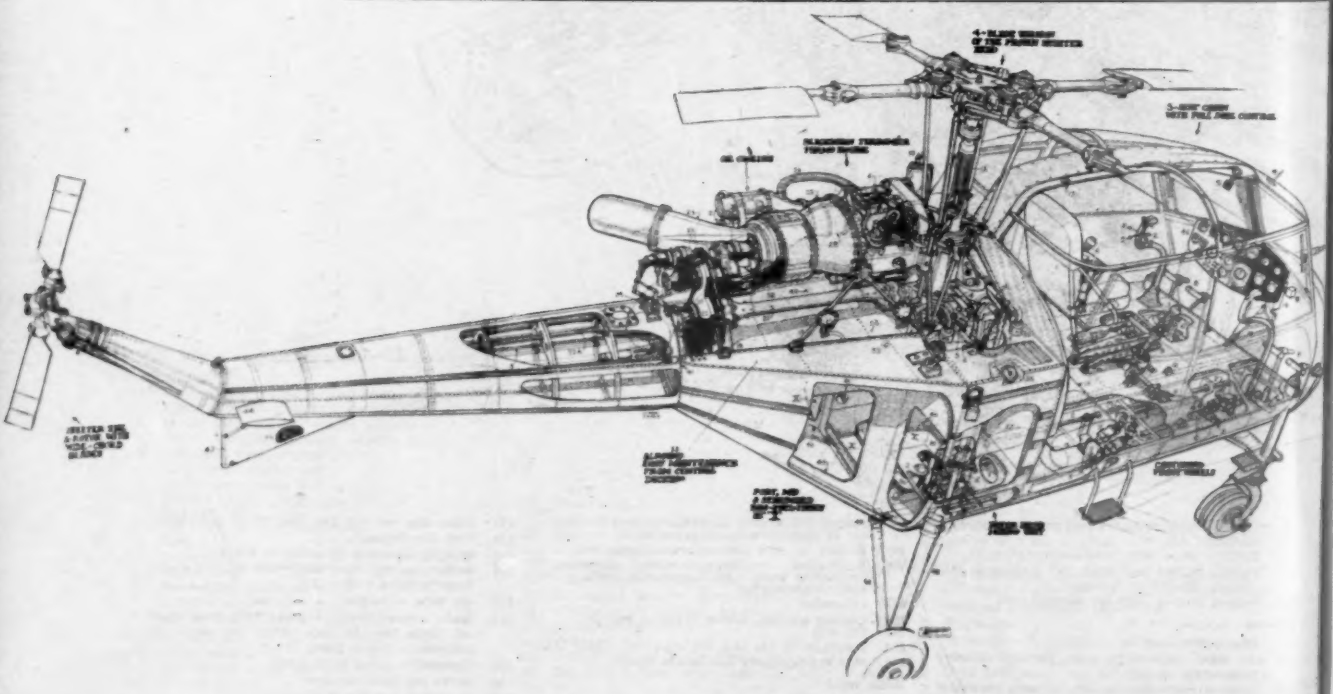
**KEY**

1. Cantilevered nose structure.
2. Front pressure bulkhead.
3. Bomb aimer's window.
4. Access door.
5. "Sandwich"-type windscreen.
6. Entrance door.
7. Flight deck.
8. Periscope.
9. 10, 11. Radar operator, navigator, electronics officer.
12. Dinghy stowage.
13. Rear pressure bulkhead.
14. Cabin air intake.
15. Nose-wheel door.
16. Bomb-bay door.
17. Fuel-tank space.
18. Centre-section rib structure.
19. Air-brake guide structure.
20. Air-brake (honeycomb structure).
21. Main-wheel pivot point.
22. Front-spar upper joint.
23. Main wheel-bay structure.
24. Engine-access doors.
25. Main-wheel door—front.
26. Main-wheel door—rear.
27. Engine tail-pipe fairings.
28. Rear spar passing through fuselage.
29. Fin main-spar fuselage joint.
30. Rear-spar upper joint.
31. Rudder shroud.
32. Fin moulded tip.
33. Moulded rear fairing.
34. Jet-pipe insulation attachments.
35. Jet-pipe end caps.
36. Pressure-balance attachment "beak."
37. Anti-icing ducting.
38, 39, 40, 41. Main ribs.
42. Warren girder structure of engine-bay rib.
43. Tail parachute stowage.
44. Top-hat section stringer
45. T-section stringer for skin panel joint.
46. Main-wheel casting.
47. Nose-wheel casting.
48. One-piece rudder and torsion box.
49. Wing control-surface shroud
50. Elevator-hinge point.

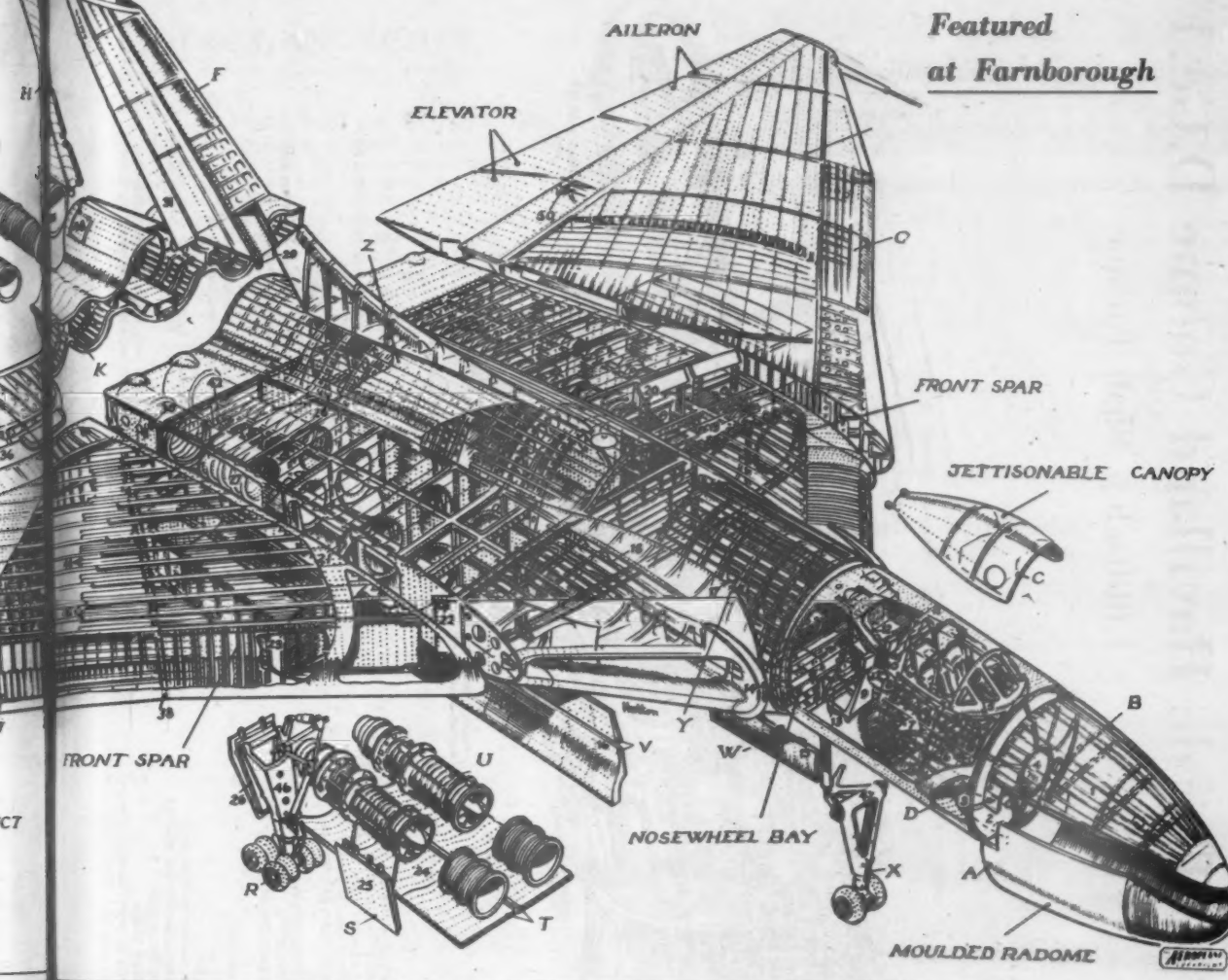
**Sub-assemblies**

A. Nose radome.
B. Nose top decking.
C. Canopy.
D. Front fuselage.
E. Outer wing.
F. Fin.
G. Fin cap.
H. Rudder.
J. Rear fairing.
K. Rear fuselage.
L. Jet-pipe end cap.
M. Jet-pipe insulation.
N. Elevator.
O. Aileron.
P. Pitot head.
Q. Wing leading edge.
R. Main-wheel unit.
S. Main-wheel doors.
T. Engine-bay doors.
U. Powerplants.
V. Bomb-bay doors.
W. Nose-wheel doors.
X. Nose-wheel unit.
Y. Nose-wheel bay, intake assembly.
Z. Main wing centre-section.



*Featured at Farnborough*




# Saunders-Roe P.531

## One Blackburn-Turboméca Turmo 600

## 450-s.h.p. Shaft Turbine

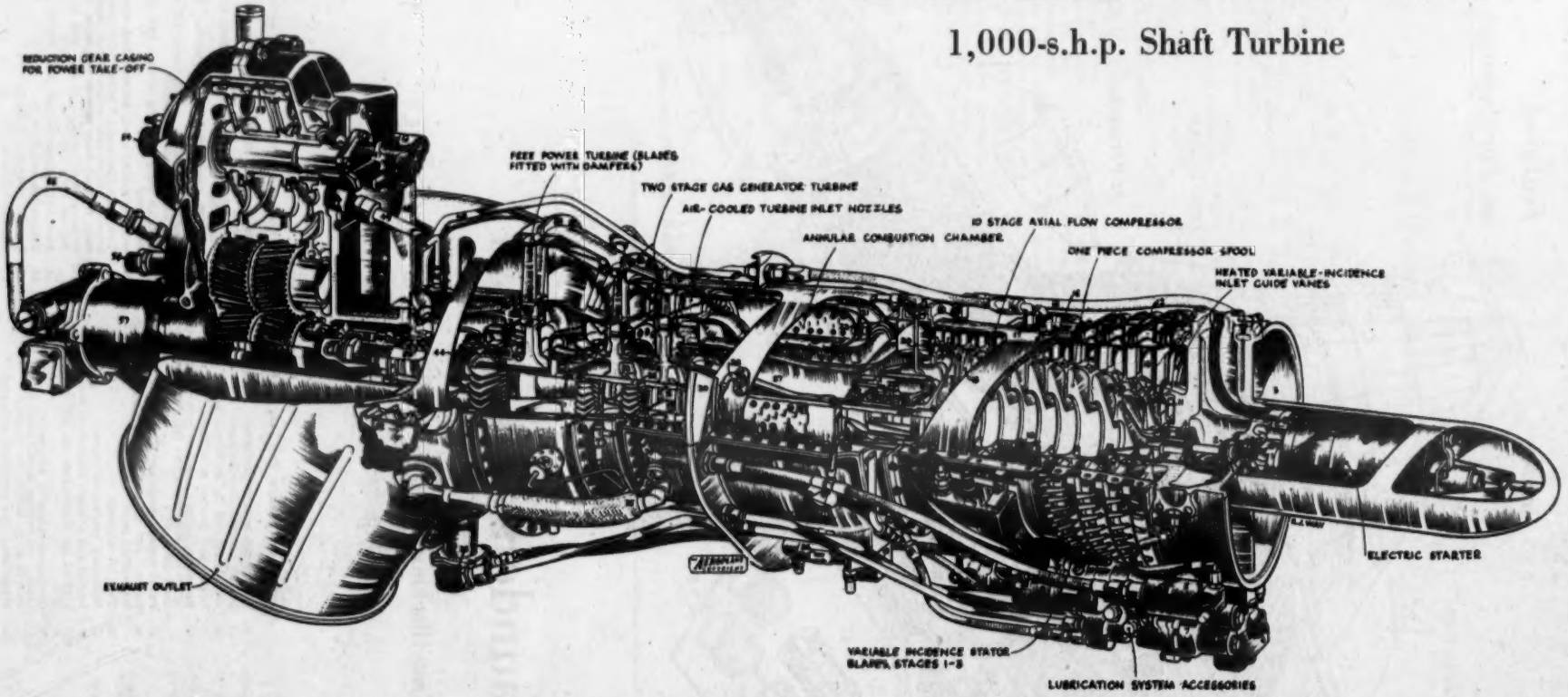
**KEY**

1. Collective-pitch control (with spring-loading (1A) in pylon).
2. Cyclic-pitch (fore-and-aft) to operate arms (4) contrariwise.
3. Cyclic-pitch (lateral) to operate arms (4) in unison. With final motion for (1), (2) and (3) all on arm (5).
6. Twist grips (throttle) and control-run.
7. Cyclic-pitch electric trim-jacks (rubber bush mountings (7A) give self-centring and stick "feel").
8. Tail-rotor pitch control (rudder bars and runs).
9. Rotor brake control.
10. Wheel brake control.
11. Extinguisher.
12. Seat fixings.
13. Line of rear (three) seats.
14. Radio.
15. Rotor r.p.m. control (H.P. fuel cock on port side).
16. Air temperature thermometer.
17. Lamps (cockpit illumination).
18. Remote control for Plessey radio.
19. Engine and gearbox mountings.
20. Reduction gearbox and free turbine with take-off (21) to main rotor and (23) to tail rotor via shaft (22A).
23. Power turbine governor.
24. Desayn for selected rotor r.p.m. dial on instrument panel.
25. Twin jet exhausts.
26. Secondary gearbox-oil cooler.
27. Engine and primary gearbox-oil cooler.
28. Line of fan which puts air through (26) and (27).
29. Cooling-air bleed to generator. (Note: Oil-cooling unit drawn higher-placed than in actual layout, for clarity.)
30. Air-intakes (one each side) to engine.
31. Primary reduction gearcase and attachment (32).
33. Stainless-steel (fireproof) decking with well (34).
35. Fuel filler-cap and interconnections (36) between fuel bags.
37. Line of access panel (for insertion of fuel bag). (Battery housed in compartment aft of fuel tank on port side of fuselage.)
38. Vertical trunk carrying control rods through tank-space.
39. Interconnecting vents between fuel bags.
40. Two main fore-and-aft beams (keel members), between centre and outboard fuel tanks, run right through from nose to tail fixing (41).
42. Undercarriage radius-rods (42) pick up as at (43) off keels (40).
44. Electrically actuated tail trim plane.
45. Honeycomb-structure fin.
46. Cockpit instrument panel.
47. Tubular tail skid.

*Featured at Farnborough*

# The de Havilland Gnome D.Ge.1

## 1,000-s.h.p. Shaft Turbine


REDUCTION GEAR CASING FOR POWER TAKE-OFF
FREE POWER TURBINE (BLADES FITTED WITH DAMPERS)
TWO STAGE GAS GENERATOR TURBINE
AIR-COOLED TURBINE INLET NOZZLES
ANNULAR COMBUSTION CHAMBER
10 STAGE AXIAL FLOW COMPRESSOR
ONE PIECE COMPRESSOR SPOOL
HEATED VARIABLE-INCIDENCE INLET GUIDE VANES
ELECTRIC STARTER
EXHAUST OUTLET
VARIABLE INCIDENCE STATOR BLADES, STAGES 1-3
LUBRICATION SYSTEM ACCESSORIES

**KEY**

1. Three-tooth starter clutch.
2. Engine accessory drive bevels.
3. Aluminium-alloy air intake casing, with heated struts.
4. Gas-generator front roller-bearing.
5. Oil filter.
6. Engine accessory gearbox.
7. Oil pump.
8. Tacho-generator.
9. Igniter box.
10. Stator ring with brazed-in blades.
11. Labyrinth balance seal.
12. Stator actuating ring (first three stages, and I.G.V.s).
13. Stages one and two compressor blades with twin-tang fir-tree roots.
14. Stages three to 10 compressor blades with circumferential dovetail roots.
15. Actuator for I.G.V.s and stators (one to three).
16. Air bleed to entry casing and I.G.V.s.
17. Stainless steel two-piece compressor casing.
18. Air impeller for turbine cooling.
19. Final-stage stators and exit guide vanes.
20. Centre bearing breather pipe.
21. Combustion chamber front support.
22. Fuel nozzle and manifold.
23. Gas-generator centre ball-bearing.
24. Air splitter.
25. Combustion chamber primary air holes.
26. Fuel flow divider.
27. Rear compressor frame.
28. Igniter.
29. Turbine front shaft.
30. Firewall.
31. Centre tie-bolt.
32. Turbine air cooling holes in tie-bolt.
33. Turbine inter-stage toothed coupling.
34. Bearing lubrication pipe.
35. Air bleed from nozzle.
36. Flexible drive to power-turbine governor.
37. Oil scavenge pipe from power-turbine bearings.
38. Bevel box.
39. Thermocouple.
40. Stage-two turbine honeycomb seal, and cooling plate.
41. Gas-generator rear roller-bearing.
42. Power-turbine dampers.
43. Power-turbine front roller-bearing.
44. Worm drive to bevel box.
45. Oil feed to power-turbine bearings and worm gear.
46. Cooling air to power-turbine bearings.
47. Emergency overspeed governor.
48. Heat shield.
49. Air pipe to overspeed governor.
50. Power-turbine rear ball-bearing.
51. Gearbox coupling.
52. Bevel box alternative mounting.
53. Oil shield.
54. Output shaft.
55. Oil scavenge pipe from reduction-gear pump.
56. Oil supply pipe to reduction-gear pump.
57. Reduction-gear oil pump.

# Correspondence

## Flying-boats for Troop-carrying

A DIRECT question is posed in the final sentence of the leading article of THE AEROPLANE (August 15). Could the Princess flying-boats have been used in the present emergency to maintain an airlift to our forces in Amman?

Assuming that these boats had been satisfactorily engined, the answer is, of course, in the affirmative.

Although the Saro Princess flying-boats were designed for a specific route, their World-wide use was kept well in mind, so that operation independent of prepared bases is feasible. This follows tradition in the general design of flying-boats. The approach to Akaba via the African Lakes as suggested in the leading article is no doubt one possible route. Much groundwork has been done in investigating routes open to the Princess flying-boats to almost every quarter of the World; information which was submitted in my time to the appropriate quarter.

Power for these flying-boats is now no problem, various alternatives being available.

Possibly the greatest overall benefit comes from fitting six Rolls-Royce Tynes. With these engines, I am informed, the Princess shows an estimated gross range of 5,300 miles carrying 22 tons payload. The Bristol Proteus for which the aircraft was designed has been available for some time in its fully rated form and naturally offers the original performance. Either of these arrangements would make the Princess flying-boats suitable for use in the present emergency.

Finally, as has been freely discussed in the popular Press, there is the possibility of fitting the Princess with a nuclear powerplant. Distance problems will then cease to exist, and speed of reinforcement by almost any roundabout route will be rapid due to the avoidance of refuelling stops.

Ryde, I.o.W. HENRY KNOWLER.

## Airlift History

WITH the assistance of the Air Ministry and others I am writing a factual account of the Berlin Airlift.

My material is being drawn largely from the personal stories of people who were closely connected with the lift and the blockade.

While it is proving reasonably simple to locate Berliners and members of the Army, U.S.A.F., U.S.N. and civil personnel, I am having great difficulty in finding R.A.F. personnel, especially other ranks.

I wonder whether it would be possible for you to publish a short appeal in your magazine on my behalf, to the effect that I should be glad to hear from past or present R.A.F. officers and men who took part in Operations "Knicker," "Carter Paterson" and/or "Plainfare" in any capacity, and especially those engaged on maintenance, signals, Air Traffic Control, radar work and other groundstaff jobs at stations in Germany?

ROBERT RODRIGO.

Flat 2, The Hollies,
Chiswick Mall,
London, W.4.

## Sailplanes at Leszno

I AM grateful to Commander Goodhart for providing the correct analysis of the most successful sailplanes at Leszno (THE AEROPLANE, August 29).

I was well aware that the marks in the Open and Standard Classes were separately computed and did myself originally attempt to re-work them into a combined classification. However, I was prevented from completing this by lack of all the necessary information. My own short-cut method, of simply combining the Open and Standard Class classifications into one list, was adopted as a "second best." Nick Goodhart has shown that it is less valid than I thought it would be.

The corrected listing of the successful types at Leszno suggests a number of interesting modifications to the previous conclusions. These are:—

(1) That the Standard Class machines were rather less effective than at first appeared. Their best performance was ninth and not second and there were seven (not eight) of them in the first 20.

(2) The importance of laminar wing sections is emphasized still further.

(3) The trend continues towards greater wing spans for highest performance. This trend has not been significantly modified by the introduction of the Standard Class.

(4) The relatively unsophisticated Skylark III—with its low wing loading—shows up better than was originally suggested. This could be interpreted as meaning that the decline in Britain's success in sailplane design is less serious than was implied.

Two other corrections should be made to the article. There is an error in the caption of the top left-hand photograph on the second page of Part 2 (page 239 of THE AEROPLANE, August 15, 1958). The cockpit illustrated is of the Mucha-100 and not the Mucha-Standart, which is shown in the photograph alongside.

Further information about the new Czech L.21 Spartak sailplane has recently become available. This amplifies and corrects some of the data previously published. It appears that the wing of the Spartak is 18 and not 16 metres in span (as previously reported) and that it is 16 square metres in area. The Spartak is thus of similar span to the Démant, while its wing loading, at a maximum permissible weight of 485 kg. (including 100 kg. of water ballast), is 30.3 kg./m.$^2$—as surmised, somewhat higher than the 28.7 kg./m.$^2$ of the Démant. The Spartak has a laminar NACA 65618 wing section at the root and NACA 63612 at the tip. It has therefore a significantly thicker wing than the Démant.

If I may, I should like to conclude by acknowledging—somewhat belatedly—the assistance in the preparation of the Leszno article which was given me by Mr. B. S. Shenstone, who also took a number of the photographs used as illustrations.

Ruislip, Middx. PETER W. BROOKS.

## Historic Data Wanted

I AM trying to collect information on an aeroplane built in 1909 by my father and his brother. The first flight was in 1910 and it was entered in the *Daily Mail* Race in 1911.

The aeroplane had two particularly outstanding points: 1, folding wings, and 2, retracting wheels.

The aeroplane was built by the Sanders Aeroplane Company, The Common, Beccles.

Barton-on-Sea, Hants. J. H. SANDERS.

The aeroplane referred to above by Mr. Sanders.

## No. 46 Squadron Reunions

I AM terribly sorry to see that your correspondent C. J. Marchant (THE AEROPLANE, August 1) has taken my letter so hard. I find it a little difficult to understand why my remarks were so "contrary to the spirit of the old R.F.C." and even more so, why the achievements of "46" were dragged into it at all. Surely only Mr. Marchant could possibly see any connection between such achievements, on the number of people attending dinners, and the definition of a reunion dinner.

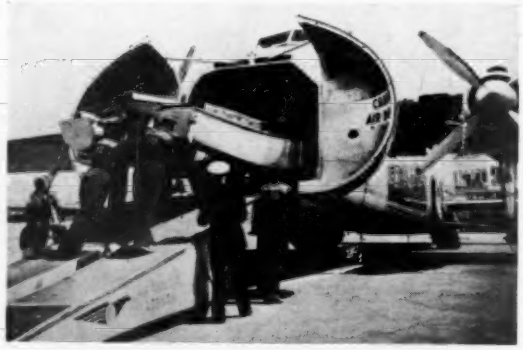
I neither made, nor had any desire to make, any disparaging remarks concerning "46." Nor will I bother to compete concerning achievements; beside that might be "contrary to"—etc., etc.

The only point I tried to make was that a reunion ("union after separation") was usually regarded as an annual event held after the break-up of a team and not any dinner held while the team was still on the job. For example, a band of people might climb a mountain or perform some such feat, in say 1950. Then in 1951, perhaps they would hold a *re*-union and they could only have had a maximum of eight reunions to date. Surely it is as simple as that. By all means hold a dinner to celebrate a C.O.'s marriage; very nice too. Also have dinner in honour of any other happenings to other officers (not forgetting their ladies, of course). But they would hardly come under the heading of reunions *as these events are generally understood*.

However, it is a small matter and I hope that members of "46" will enjoy many more dinners together, even if they reach 100 before "49" had reached half that number of reunion dinners.

Potters Bar, Middx. A. H. CURTIS, Sqn. Ldr.

# NOTES AND EVENTS



CROSS-CHANNEL CAT.—Recently flown out to Belgium by Air Charter, Ltd., was a 14-ft. Catamanner (a type of catamaran), unpacked and complete on its trailer. It is seen here being loaded into a Bristol Freighter at Southend Airport.

**GOODYEAR REORGANIZATION.**—The Goodyear Tyre and Rubber Co. (Great Britain), Ltd., is discontinuing manufacture of its range of aviation metal products at its Wallasey factory, which is to close in the near future. Under its new manager, Mr. C. D. Hackman, the Aviation Products Division of the company is to concentrate its operations at Wolverhampton.

## Meteorology Lectures

A SERIES of eight lectures on meteorology for glider pilots, which aeroplane pilots should also find useful and interesting, is to be given in London at the Kronfeld Club (No. 74 Basement, Eccleston Square, near Victoria Station) on alternate Thursday evenings from October 2 till January 22 inclusive, omitting December 25. The lectures, which start at 19.00 hrs., are being given by Dr. R. S. Scorer, of Imperial College, and Mr. C. E. Wallington, of the Meteorological Office, and among the subjects are: atmospheric structure and winds; temperature and lapse rates; fronts and jet streams; clouds and rain; weather charts and forecasting; thermals, thunderstorms and mountain waves.

Single lectures cost 2s., payable at the door, but it is cheaper to send 10s. for tickets for the whole course to the British Gliding Association, 19 Park Lane, London, W.1.

**BROWN EXPANSION.**—A London Airport branch of Brown Brothers (Aircraft), Ltd., aircraft and general engineers of Great Eastern Street, London, E.C.2, is to be opened on September 8. The address will be Viscount Way, Hatton Cross, London Airport, Middx. (Telephones, Skyport 1841-2. Comprehensive stocks of aircraft standard parts will be maintained and there will be a van delivery service for the south of England. The new office will be managed by Mr. A. Davis. The Downs Road, Hackney, office will close on September 5.

**CRANFIELD AT HOME.** — On October 10, the College of Aeronautics at Cranfield will be holding its annual Open Day for invited guests. The following day, Saturday, October 11, the College will be open to anyone who cares to make a trip to Cranfield to see what goes on there. On both these occasions the laboratories will be open from 11.00 hrs. to 18.00 hrs.

**LIQUID OXYGEN BREATHING.**—A number of Service aircraft, including the English Electric Lighting, Supermarine Scimitar, D.H. Sea Vixen, Fairey Gannet AEW.3 and Folland Gnat, are to be fitted with liquid oxygen pilot-breathing systems. Produced by British Oxygen Aro Equipment, Ltd., the systems have large weight and space-saving characteristics over the gaseous type of oxygen equipment.

**TRACTORS FOR BOEINGS.**—Qantas has bought Douglas Tugmasters type D.C.7Q for handling its Boeing 707s. Fitted with a 230-b.h.p. Diesel engine the Tugmasters have hydraulic transmission and a maximum tractive effort of 32,000 lb.

**ELECTRONICS CATALOGUE.**—Racal Engineering, Ltd., of Bracknell, Berks, has produced a comprehensive catalogue of its ranges and types of communications and digital counting equipment.

**QANTAS EQUIPMENT.** — Atlas Copco Australia Pty., Ltd., has received an order from Qantas for three compressors. They will be used for testing the cabin pressurization system and engine starting equipment of the Boeing 707 and as a power supply for workshop equipment. The compressors, which are capable of an output of 5,000 cu. ft./min., will be housed in a new building which will be put up near the Qantas repair and overhaul shop at Sydney Airport. To simulate cabin conditions at height during test, the compressed air will be cooled, filtered and heated correspondingly.

**AIRCRAFT ACTUATORS.**—A new range of linear and rotary AC actuators has been developed by the Plessey Co., Ltd., for use in aircraft. Powered by three-phase 400-c.p.s. induction motors, the units cover various rates of travel, lengths of stroke and load capacities.

**BRADFORD VISTA.**—On August 28 the directors of Hepworth and Grandage, Ltd., manufacturers of piston rings and gas-turbine blades, etc., accepted a painting commissioned by them to commemorate the company's golden jubilee celebrated last year (THE AEROPLANE, July 26, 1957). The painting is by Claude Muncaster, the landscape artist, and shows not only the factory, but also the City of Bradford and the distant Yorkshire dales.

## Aviation Calendar

**September 8-13.** — First International Congress of the Aeronautical Sciences, **Madrid.**

**September 12-22.** — Aeronautical Pentathlon and Air Rally at **Liège,** Belgium.

**September 15-21.** — Battle of Britain Week.

**September 20.** — Aviation Forum of London annual dinner, at the Aerodrome Hotel, **Croydon,** Surrey.

**September 21.**—Sailplane aerobatic competition organized by the London Gliding Club, at **Dunstable,** Beds.

**September 21.**—Air Rally organized by the Milan Aero Club, at **Milan.**

**September 21.**—Royal Belgian Aero Club international concourse for balloons, **Brussels.**

**September 21.** — Denham Flying Club garden party, at 14.30 hrs.

**September 25.**—R.Ae.S. Graduates and Students Section lecture, "The Next Generation of Civil Aircraft," by G. H. Lee (Handley Page, Ltd.), in the Library, 4 Hamilton Place, **London,** W.1, at 19.30 hrs.

**September 25-26.** — Aerodrome Owners Association annual conference, at the Hyde Park Hotel, **London,** W.1.

**September 26-29.**—Austrian Aero Club Rally at **Innsbruck.**

**September 27-28.**—"Tipsy Week-end" organized by the A.S. Flying Club, at Baginton Airport, **Coventry.**

**October 4.**—Aviation Forum of London lecture, "The Channel Air Bridge," by Douglas Whybrow, at the Imperial Hotel, Elizabeth Street, Victoria, **London,** S.W.1, at 19.00 hrs.

**October 9.**—Society of Instrument Technology, Control Section lecture, "Aircraft Flight Simulators," by Dr. A. E. Cutler, B.Sc., Ph.D., at Mansion House, Portland Place, **London,** W.1, at 17.30 hrs.

**October 16.** — R.Ae.S. Graduates and Students Section lecture, "The Fatigue of Aircraft," by Maj. P. L. Teed (Vickers-Armstrongs), in the Library, 4 Hamilton Place, **London,** W.1, at 19.30 hrs.

## Birth Notices

**Bibby.**—On August 13, at Catterick Military Hospital, to Beryl, wife of Flt. Lt. G. W. Bibby—a daughter.

**Bunker.**—On August 9, at R.A.F. Hospital, Halton, to Joy (*née* Bolsover), wife of Flt. Lt. N. Bunker—a daughter.

**Calvert.**—On August 15, at R.A.F. Hospital, Halton, to Susan (*née* Chamberlain), wife of Flt. Lt. R. A. Calvert—a son.

**Phibbs.**—On August 17, at R.A.F. Hospital, Ely, to Anne (*née* Drinkwater), wife of Flt. Lt. M. P. Phibbs—a son.

**Russell.** — On August 13, at Louth County Hospital, to Diana, wife of Flt. Lt. L. J. Russell—a son.

**Tarrant.**—On August 15, at Emsworth, Hants, to Patricia (*née* Ford), wife of Flt. Lt. M. W. Tarrant—a son.

**Venn.**—On August 13, at R.A.F. Hospital, Cosford, to Patricia (*née* Jardine), wife of Flt. Lt. M. G. P. Venn, M.B., B.S.—a daughter.

## New Patents

### APPLICATIONS ACCEPTED

802,536.—General Electric Co.—"Aircraft control systems." April 11, 1956. (April 11, 1955.)

802,672.—Sperry Gyroscope Co., Ltd.—"Control systems for aircraft."—February 15, 1957. (February 24, 1956.)

802,673.—Sperry Gyroscope Co., Ltd.—"Control systems for aircraft." February 15, 1957. (February 24, 1956.)

Applications open to public inspection on Oct. 8, 1958; opposition period expires on Jan. 8, 1959.

802,859.—General Motors Corporation.—"Engine transmissions."—March 14, 1957.

802,991.—Soc. Nationale d'Etude et de Construction de Moteurs d'Aviation.—"Devices for controlling the vertical landing of aircraft."—July 30, 1956 (Sept. 1, 1955). (Addition to 776,963.)

803,128.—Canadian Patents and Development, Ltd.—"Display for navigational instruments."—Aug. 27, 1956.

802,850.—Svenska Aeroplan A.B.—"Headrest for aircraft ejection seats."—Nov. 14, 1956 (Nov. 16, 1955).

803,030.—All American Engineering Co.—"Aircraft launching systems."—May 7, 1956.

Applications open to public inspection on Oct. 15, 1958; opposition period expires on Jan. 15, 1959.